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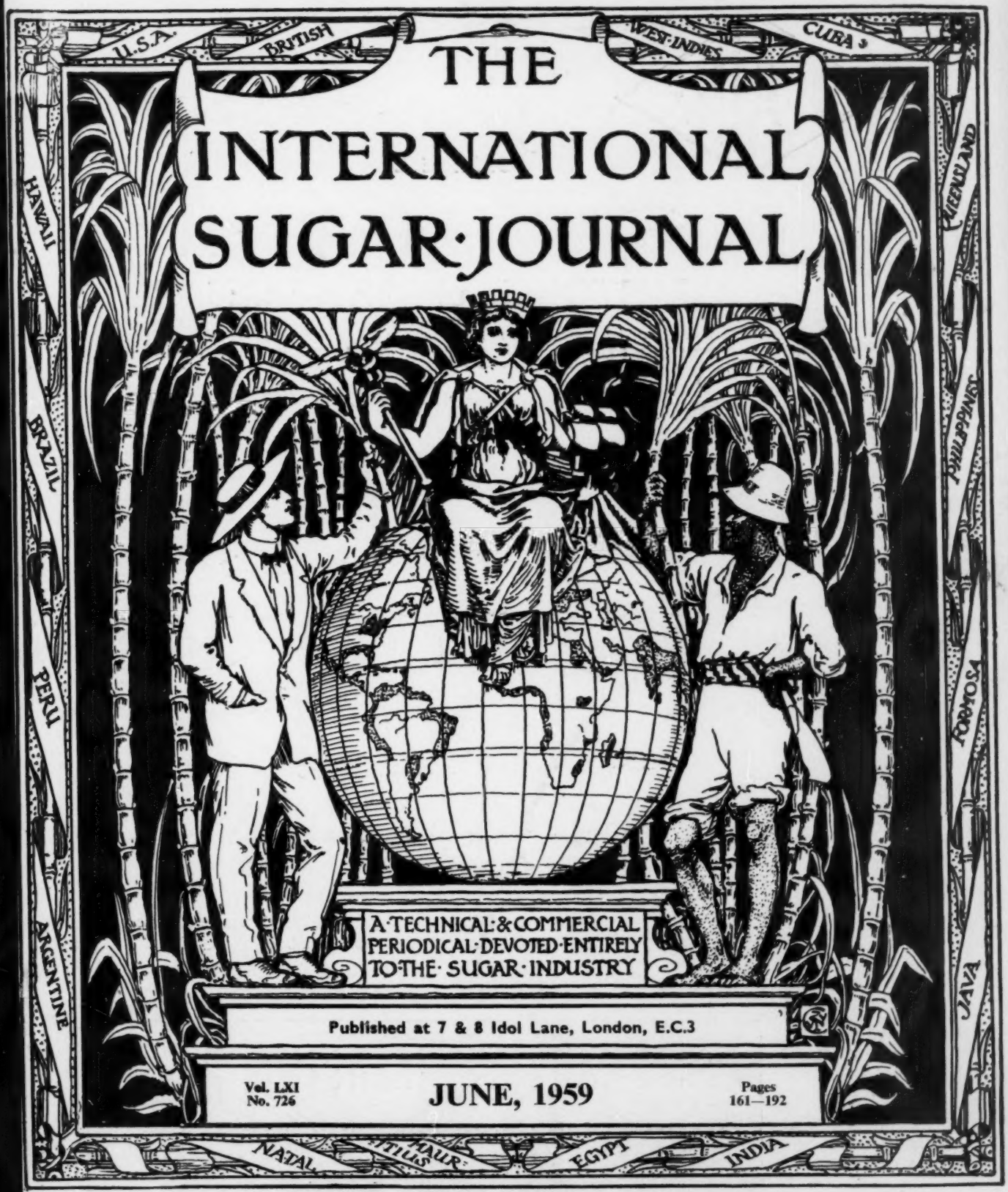

THE INTERNATIONAL SUGAR JOURNAL

A TECHNICAL & COMMERCIAL PERIODICAL DEVOTED ENTIRELY TO THE SUGAR INDUSTRY

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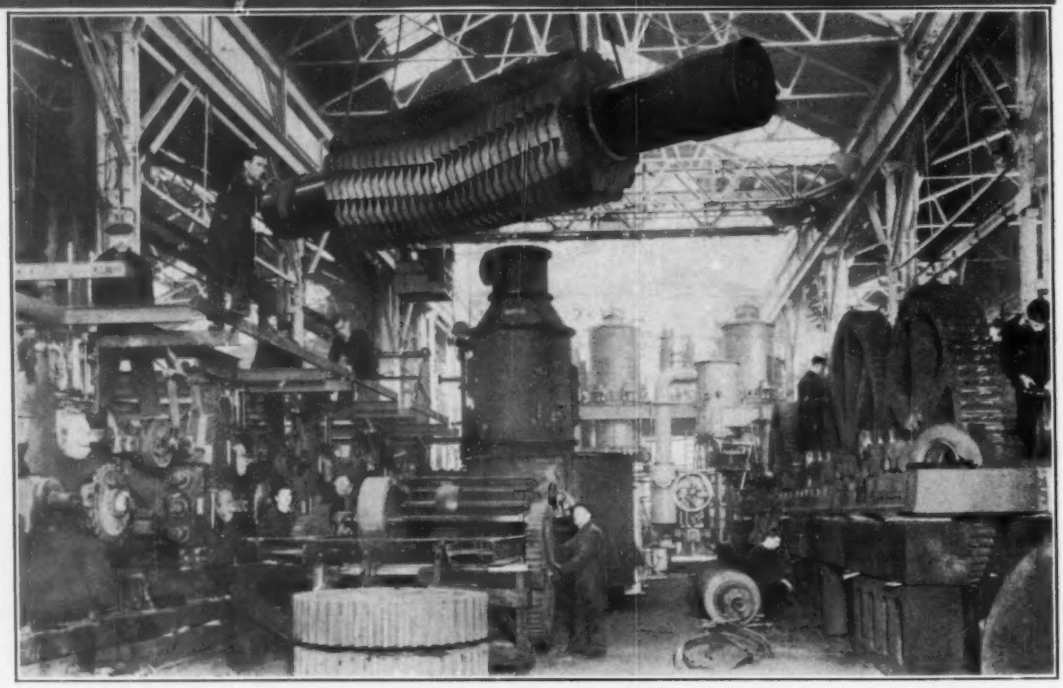

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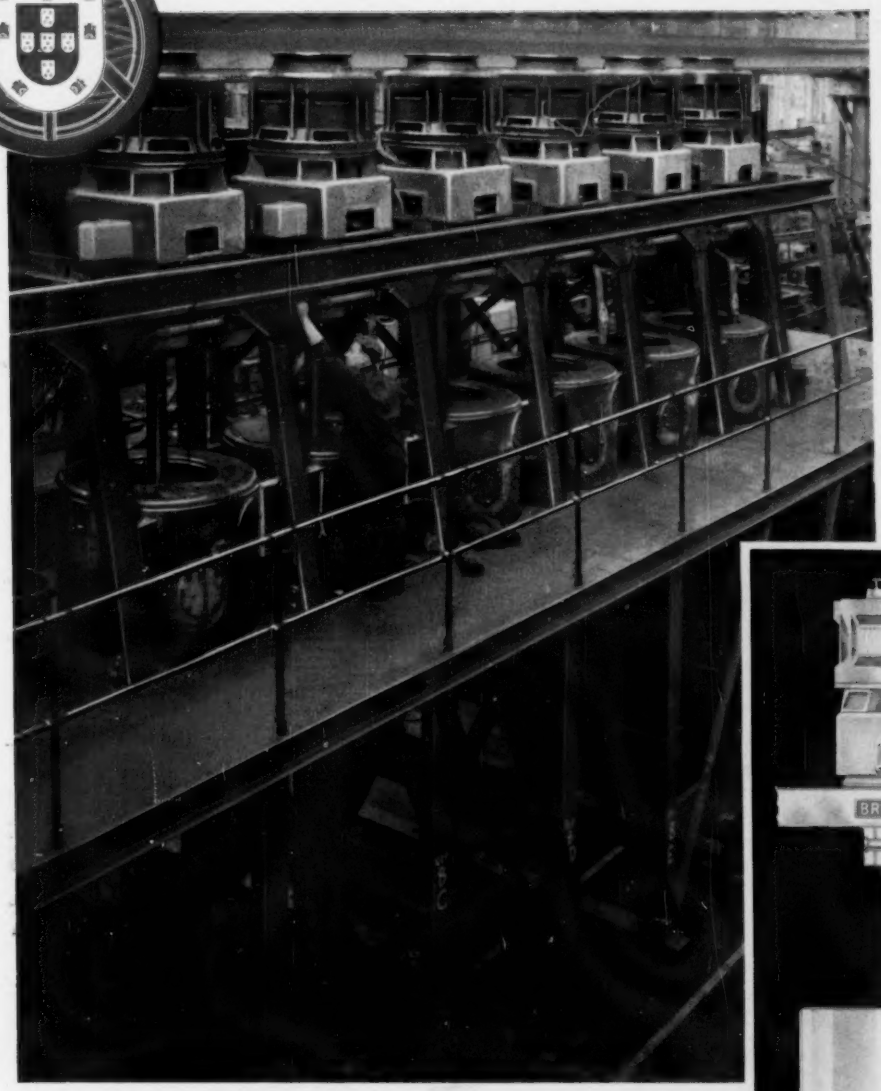

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The machines are to be installed to cure C massecuites.

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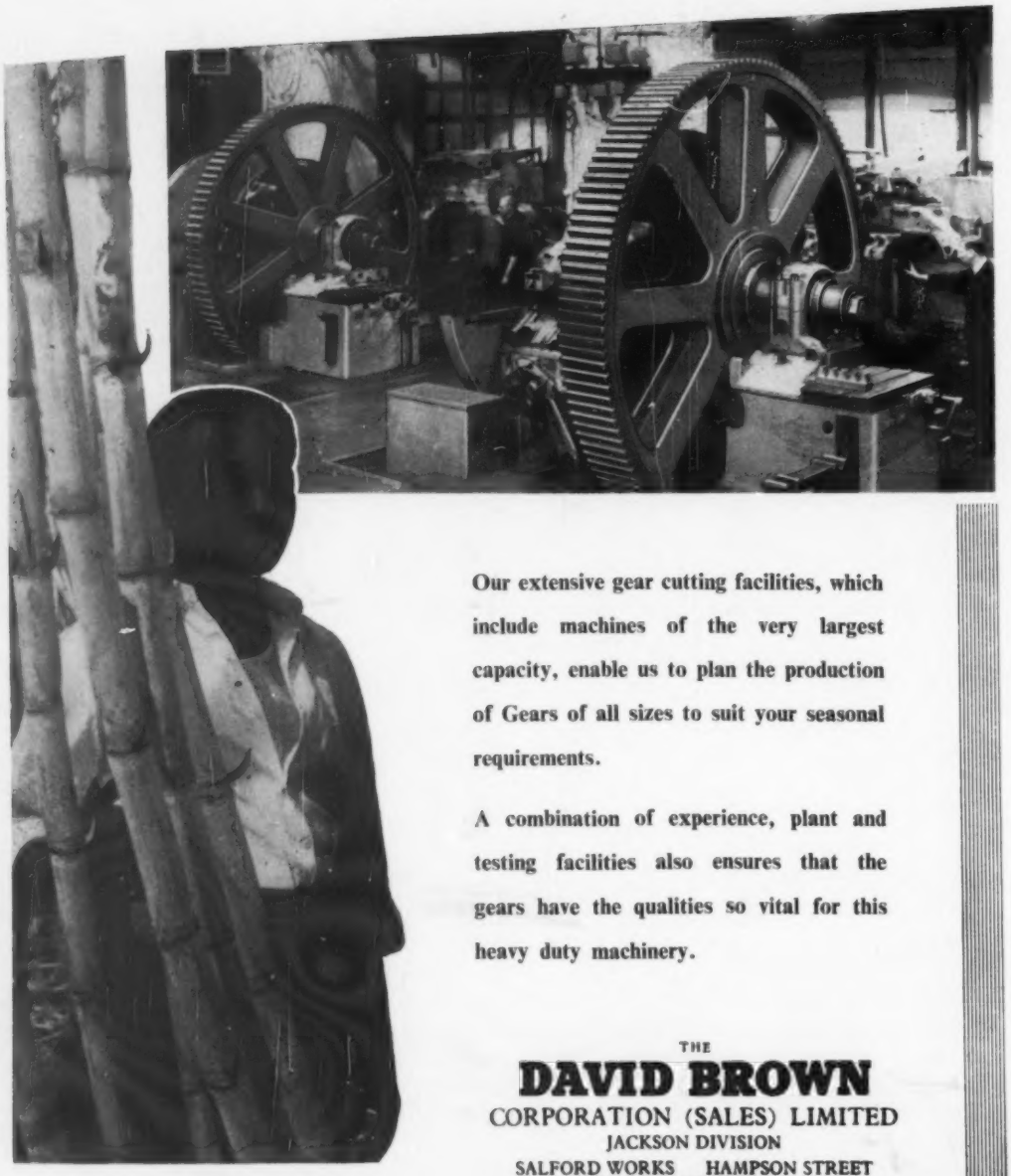

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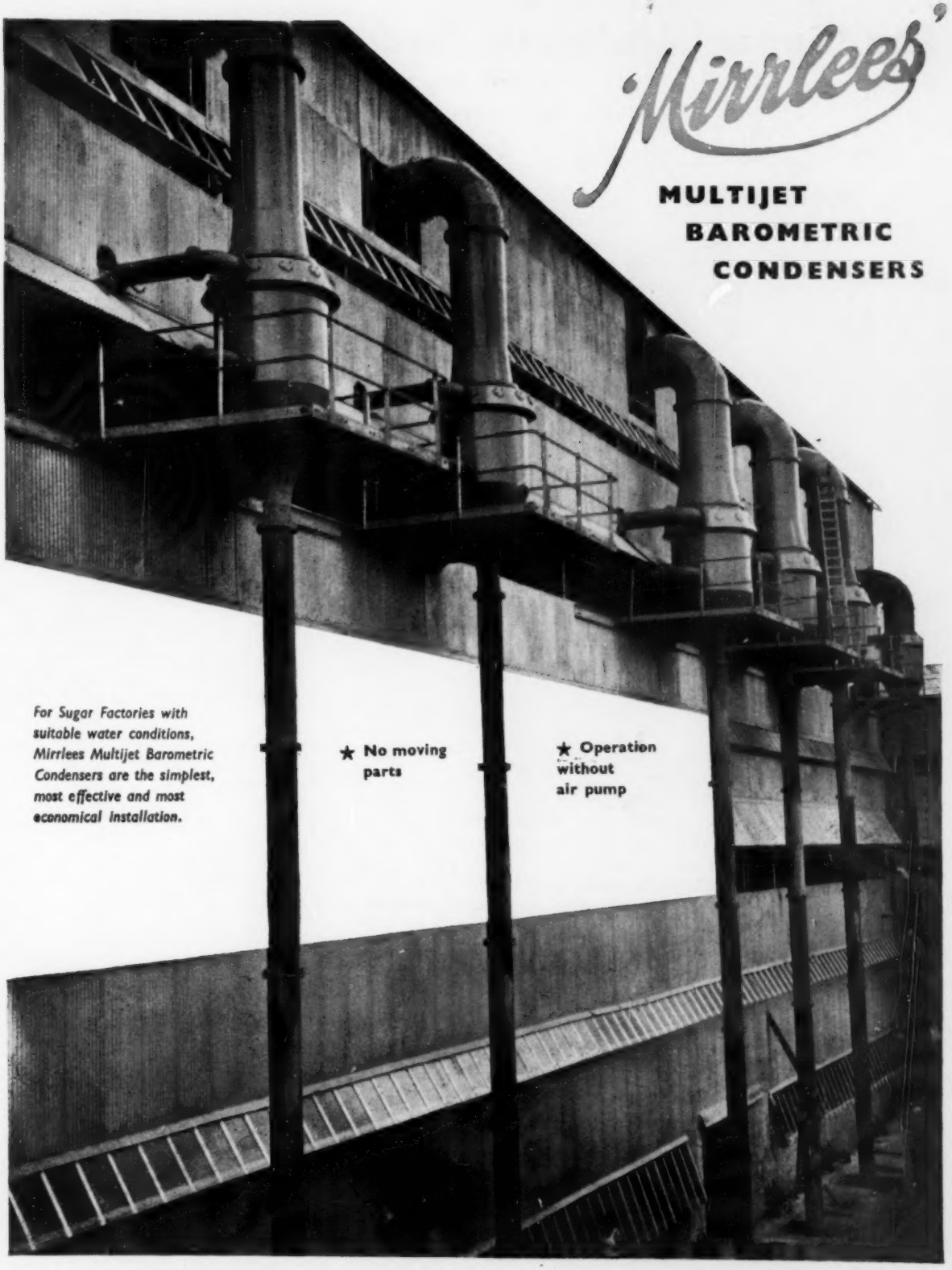

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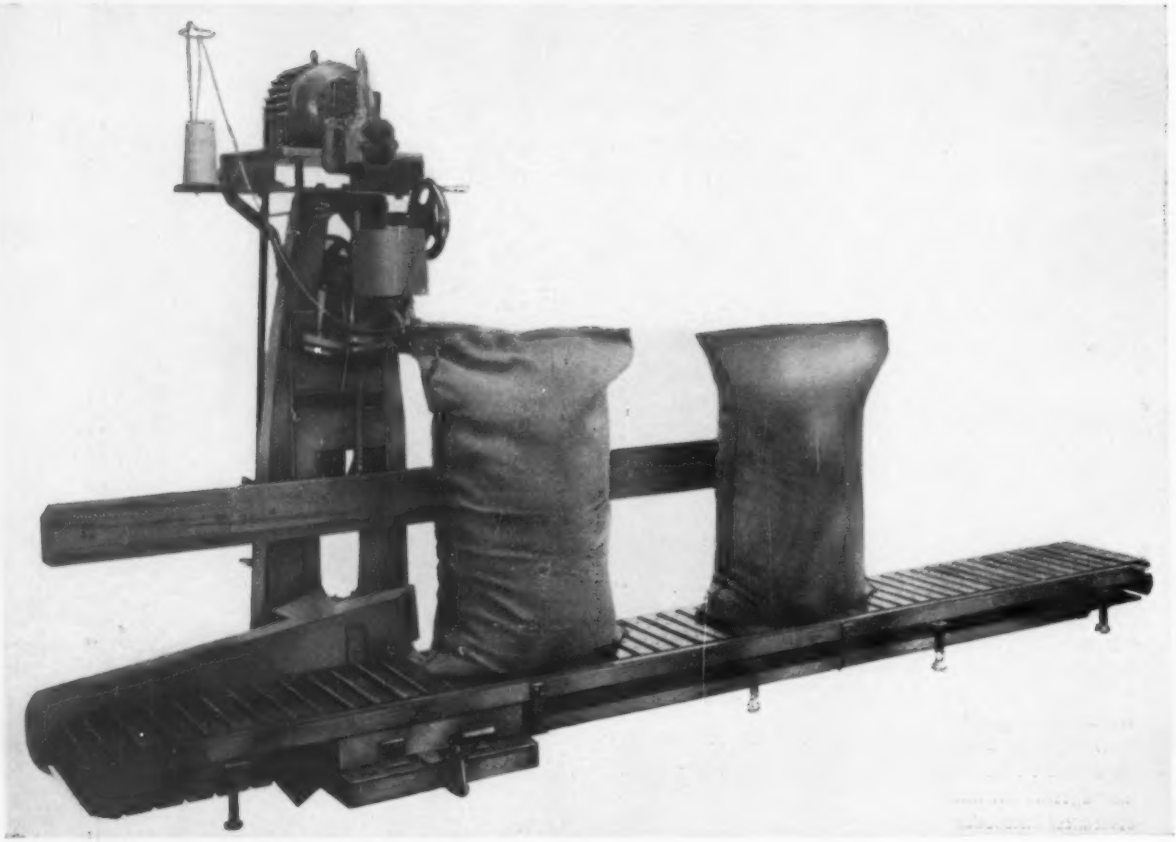
The 'Super' Universal Sack Closing Machine

MODEL NO. 5B

Fitted with 10 or 12 ft. Conveyor and Special Clutch Drive



This machine is fitted with a conveyor 10 or 12 ft. overall and a Special Clutch Drive which allows the conveyor to be run independently of the sewing head.

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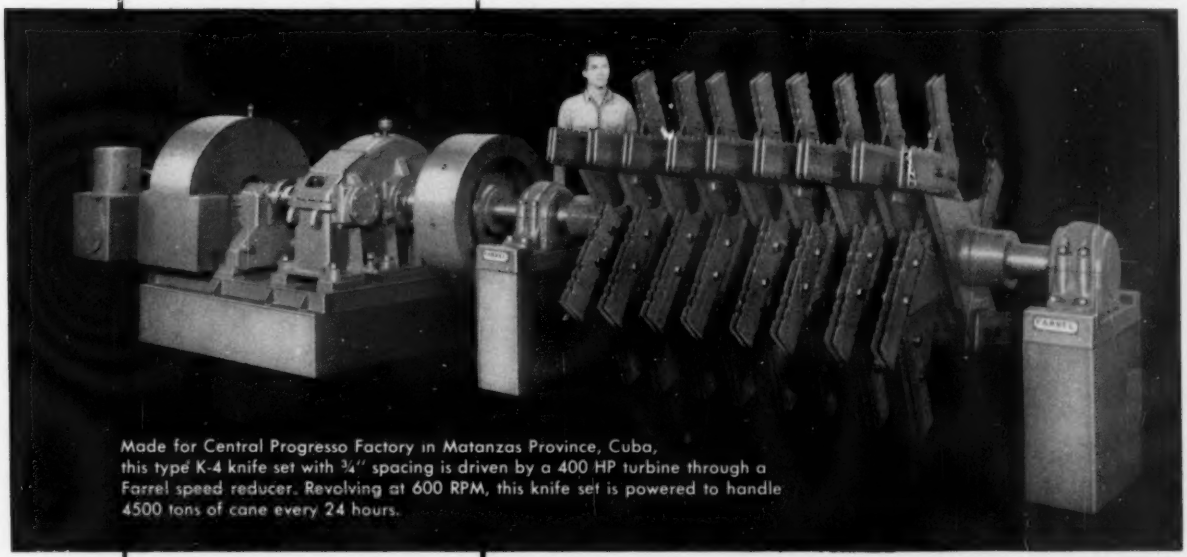
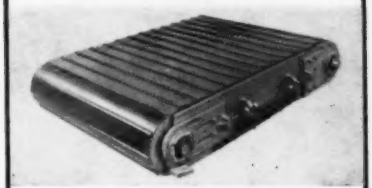


Made for Central Progresso Factory in Matanzas Province, Cuba, this type K-4 knife set with ¾" spacing is driven by a 400 HP turbine through a Farrel speed reducer. Revolving at 600 RPM, this knife set is powered to handle 4500 tons of cane every 24 hours.

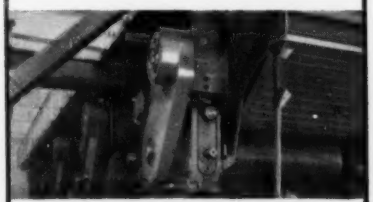
OTHER EQUIPMENT

reflecting Farrel leadership in sugar mill design



RUBBER-BELT CARRIERS

provide better retention of both bagasse and imbibition; positive cane feeding action; and there are no maintenance problems.



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used in the carrier drive, contribute to ease and safety of operation; also used between gear units of a turbine drive.

You can grind more cane, increase extraction and reduce hydraulic loading . . . with Farrel cane knives. They will shred any kind of hard or soft cane.

Several sugar factories have recently installed Farrel type K-4 knife sets, using 1½" to 2" spacing for the first set, with the knife tips about 4" from the cane conveyor, and ¾" spacing for the second set, with the knife tips set as closely as practical to the conveyor. The closer setting of the knife blades on the second set gives preparation comparable to a shredder, with less maintenance and power consumption.

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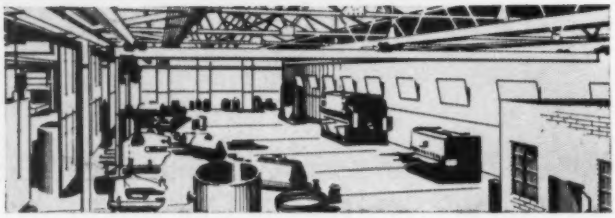
Stainless steel vessel with mild steel jacket

12,000 gallon water separator



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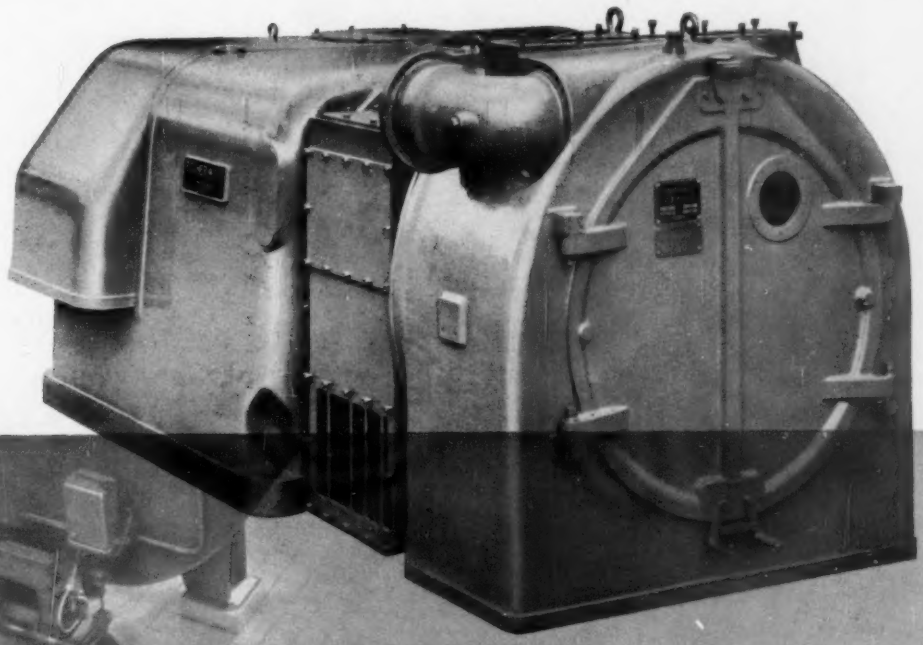
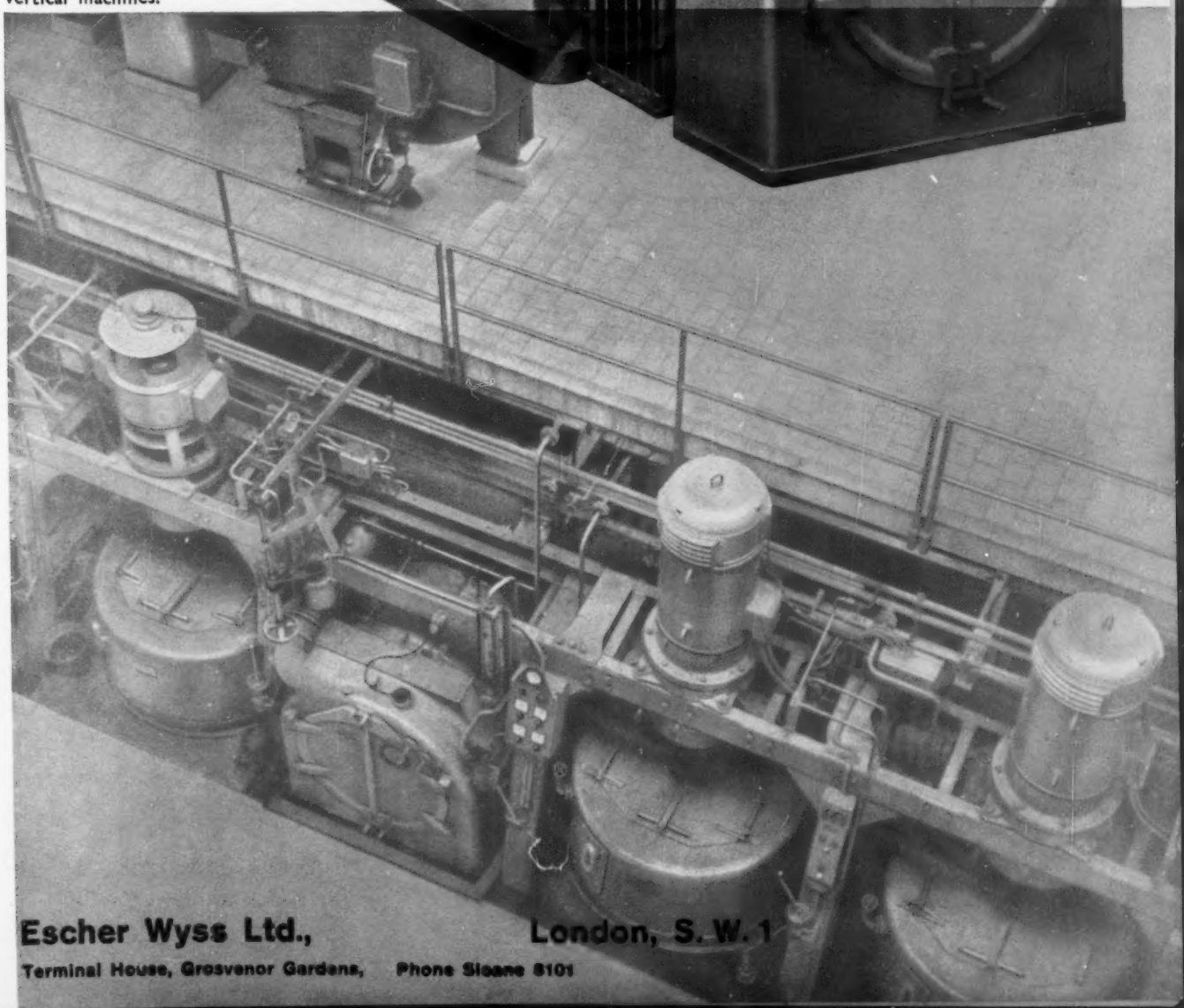


Escher Wyss Centrifuge as replacement in a battery of vertical machines.



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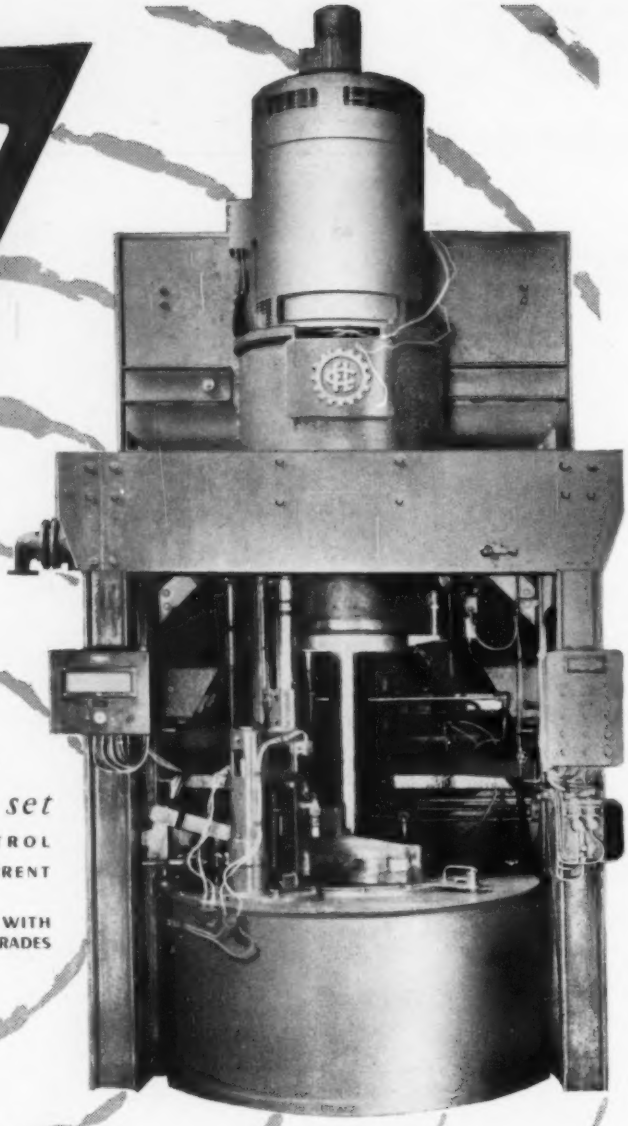

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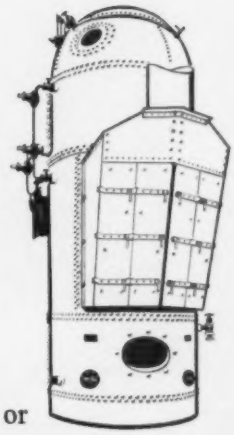
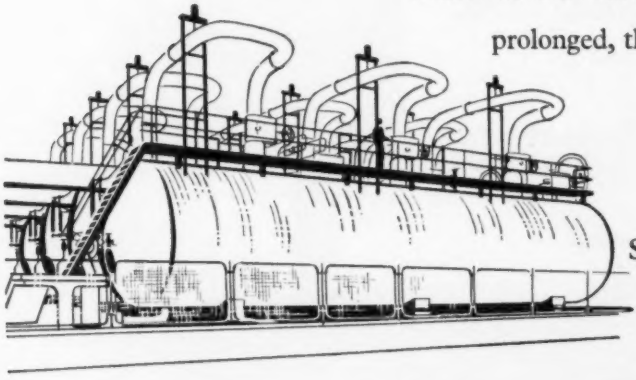
steam pressure fluctuations



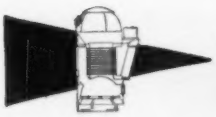
. . . are cause for anxiety and losses in many production processes. They are avoidable and where they exist consideration should be given to the means of overcoming them.

Cochran's can offer two. Where the variations in demand are not too great in relation to the boiler capacity the *Cochran Vertical Boiler with extended top belt* gives a reserve to accommodate varying demands without unnecessary changes in the boiler firing rate.



Where the load fluctuations are more violent or prolonged, the answer is in the installation of a *Ruths Steam Accumulator* to store surplus steam produced at off-peak times for release when the demand arises. A Ruths Steam Accumulator enables boilerplant to be run at a steady output and thus at its highest efficiency.

Do submit your fluctuating load problem to us.



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RUTHS STEAM ACCUMULATORS

RUTHS
Regd Trade Mark

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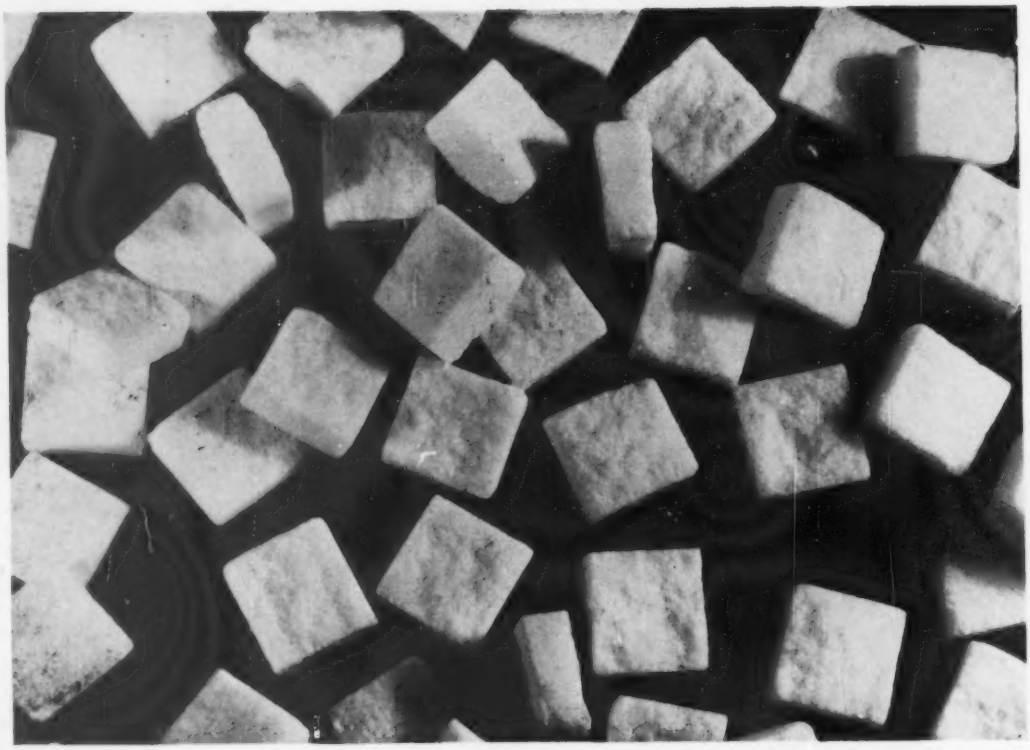

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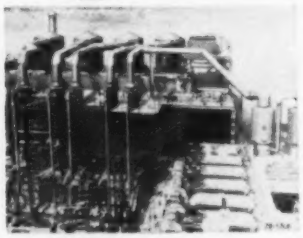

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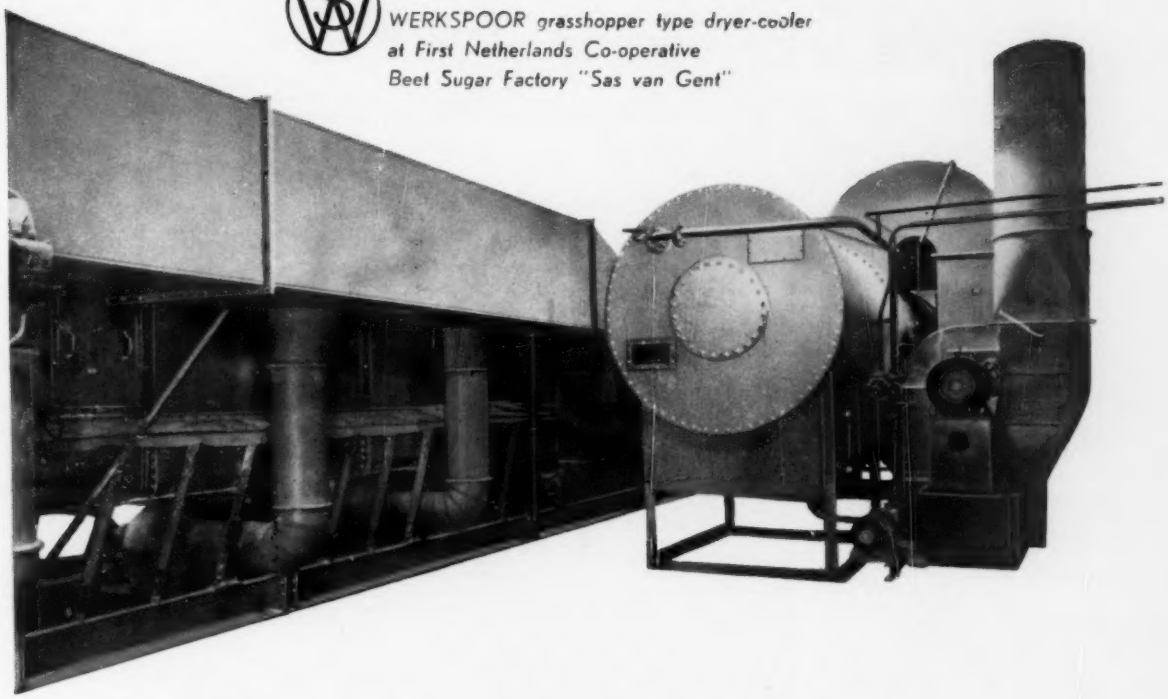
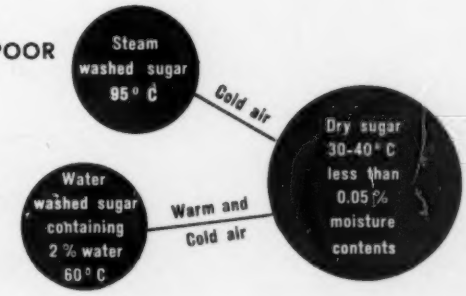
WERKSPOOR grasshopper type dryer-cooler at First Netherlands Co-operative Beet Sugar Factory "Sas van Gent"



This new WERKSPOOR *grasshopper type dryer-cooler* keeps the lustre of your sugar

with its simple and low construction, economical working, built in any capacity you may require, this modern WERKSPOOR apparatus will guarantee you:


Steam washed sugar 95° C
Cold air
Dry sugar 30-40° C less than 0.05% moisture contents
Water washed sugar containing 2% water 60° C
Warm and Cold air

- **absolutely undamaged crystals**
- **drying and cooling in record time**
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- **completely dust free atmosphere**

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For grasshopper type dryer-coolers please apply to Werkspoor, Amsterdam

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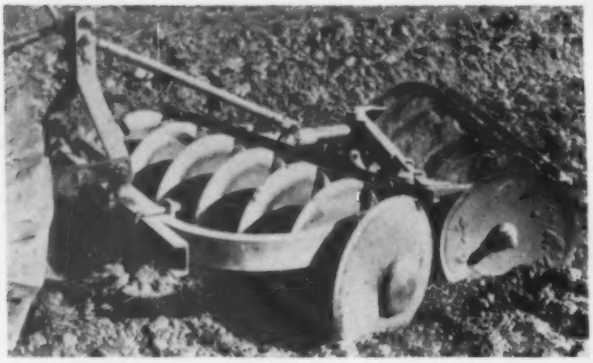
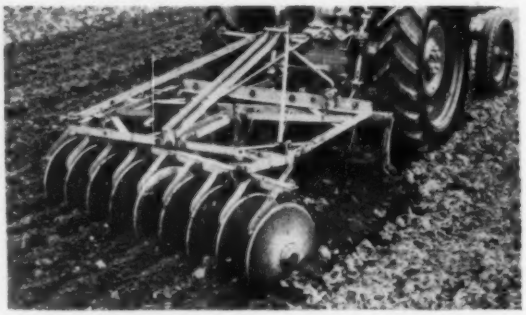
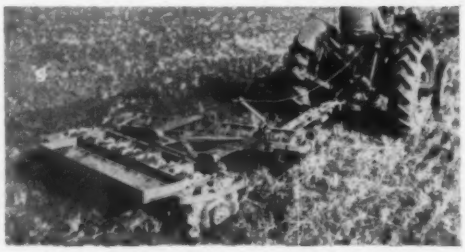
Ransomes lead the way with these modern, well-designed implements which will do a first class job with maximum economy over many years.



THR 3002. A heavy duty implement, it is ideal for use in rows about 6′ apart. Gangs can be off-set to left or right. 22″ dia. plain or cutaway discs, spaced at 9″.



HR 20 (*Right*) An extremely well-balanced compact implement; can be easily off-set to left or right; 18 discs spaced at 9″ cultivate over a width of 6′ 6″; very small turning radius.

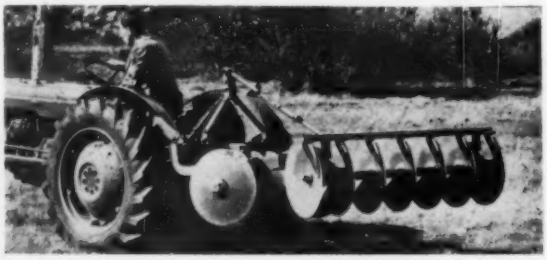


DUCHESS. An off-set implement made in sizes 7½′, 9′ and 10½′ wide. Drawbar has a full range of adjustment and there are six alternative positions for the gangs.

VISCOUNT. Available with 24, 28 or 32 discs, spaced at 6″, cultivating 6′, 7′ or 8′ at 7″ deep. Hydraulically operated wheels lift the discs clear for instant transport.

THR 1005 (*below*). Has 14 discs spaced at 9″, cultivating 5′ or off-set up to 7′ 3″. Gangs can be arranged for on-barring or off-barring.

Send for full details of this wide range of implements.



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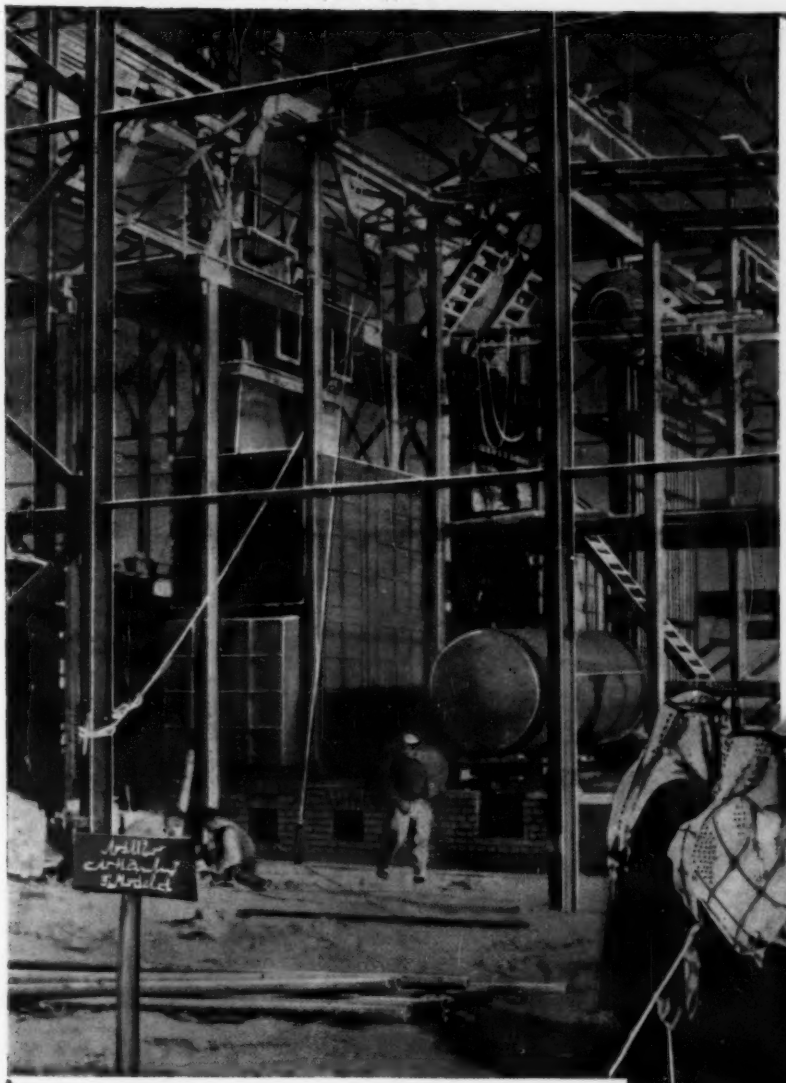
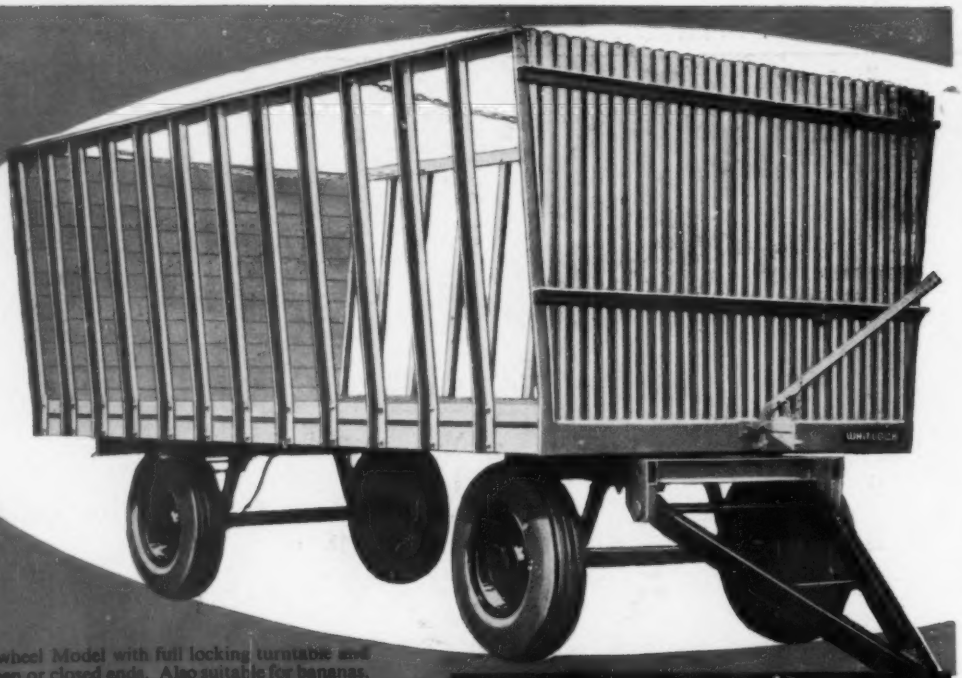


A little chat about factory routine among Arab foremen, whilst the erection of the Salzgitter sugar factory forges ahead on the sunny banks of the lazy River Tigris

SALZGITTER INDUSTRIEBAU GMBH

Consulting Engineers and General Contractors

SALZGITTER-DRÜTTE **GERMANY**

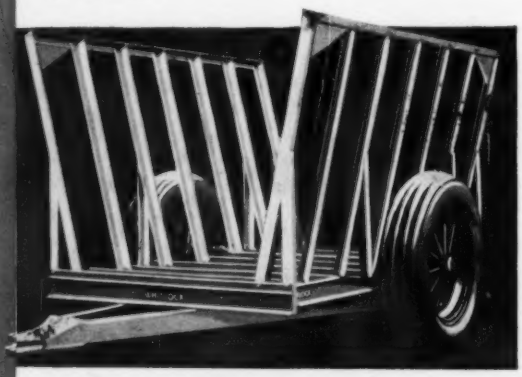


4-wheel Model with full locking turntable and open or closed ends. Also suitable for bananas. In various carrying capacities.

Cut cartage costs with

WHITLOCK CANE & FRUIT TRAILERS

4-wheel Goose-Neck type of pressed steel construction with extra heavy bracing for loads up to 6 tons.



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Our factory representatives are at the moment travelling the cane growing areas and may be visiting you personally.

Whitlock Cane Trailers are backed by many years experience and will stand-up to the job.

Ask for catalogue SC.41 and send details of your requirements.

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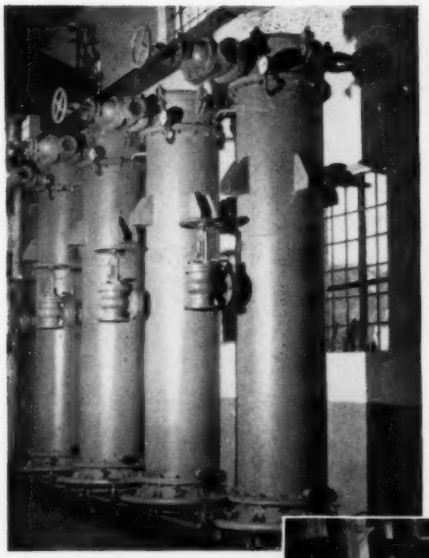

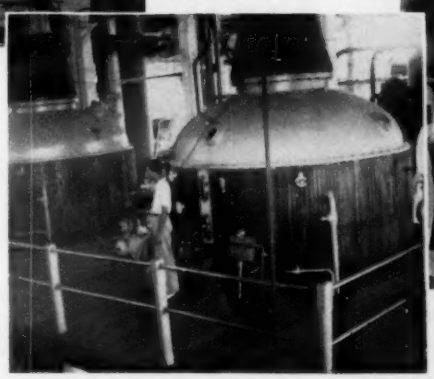

Above: Juice Heaters—Brazil; Right: Vacuum Pans—British Guiana; Extreme Right: Evaporators in one of the British Sugar Corporation Factories.

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an open letter to
SUGAR MILL MANAGEMENT
the world over

In the story of the growth of any large and important industry, certain major developments always stand out.

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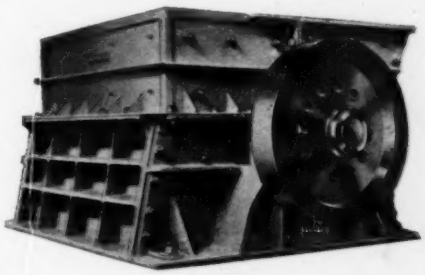

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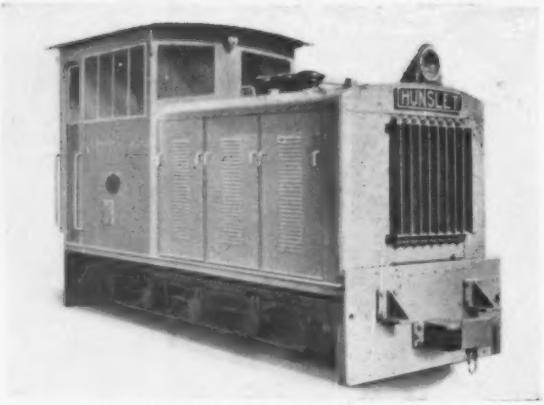

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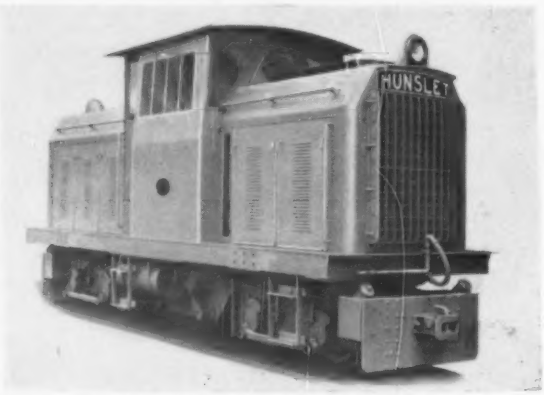

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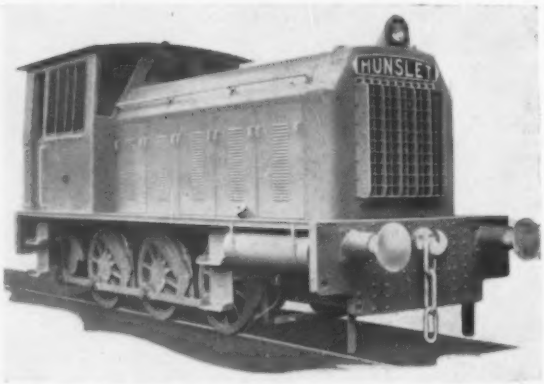

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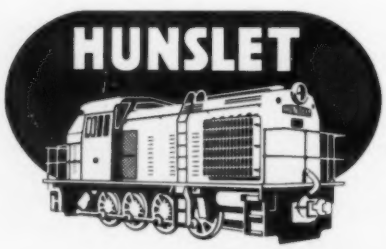

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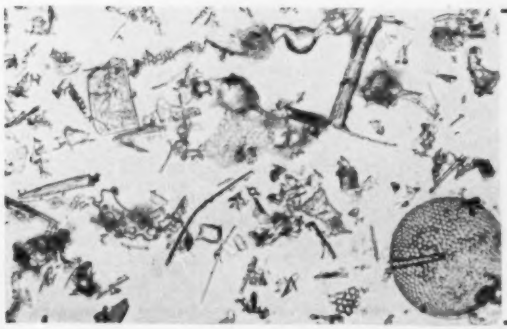

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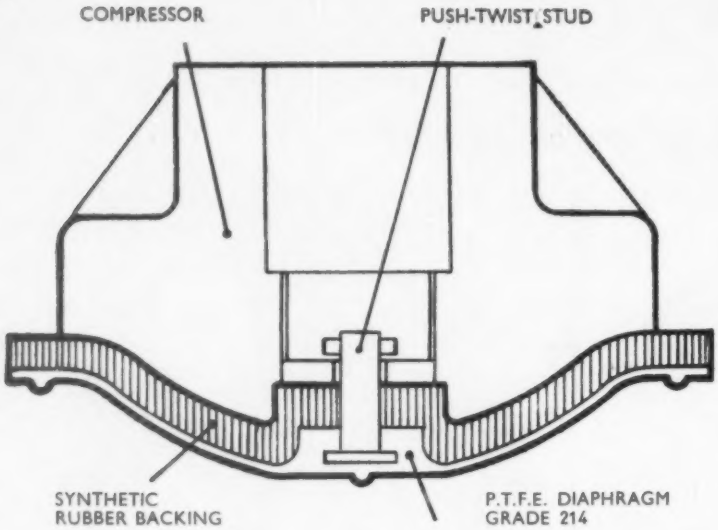

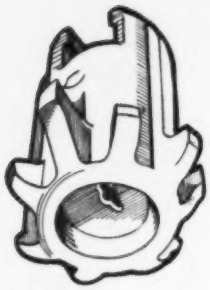

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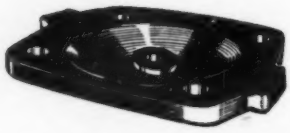

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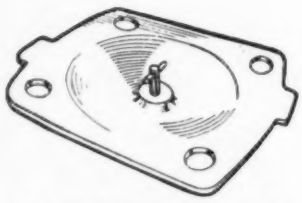

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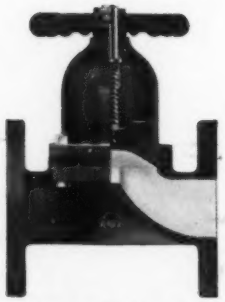

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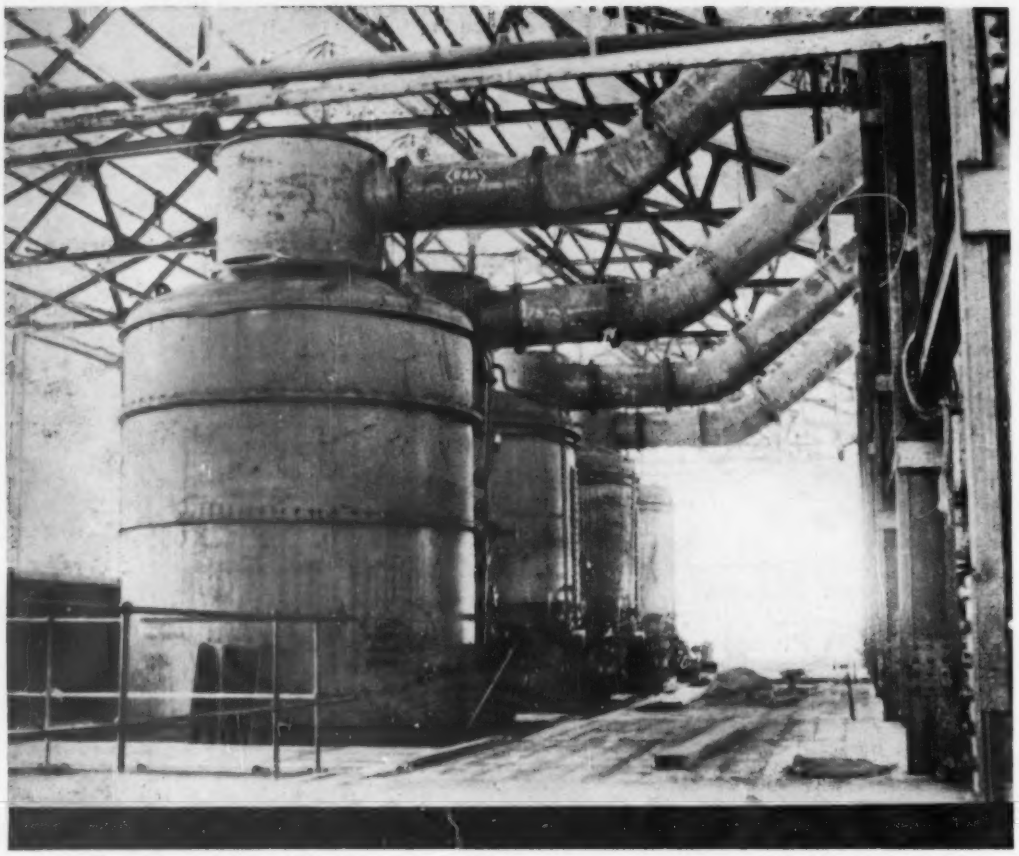

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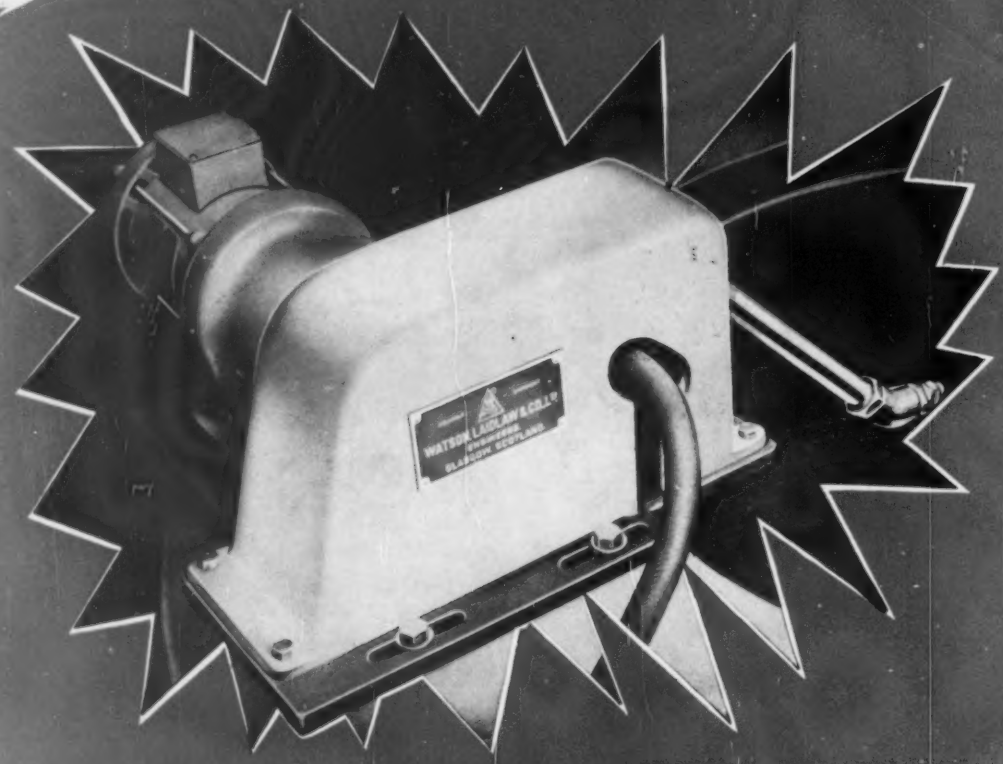

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THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXI JUNE, 1959 No. 726

NOTES AND COMMENTS

South African Sugar Crop, 1958/59[1].

The crushing season ended with a final sugar production of 1,135,423 tons, which is 175,551 tons higher than the record production for the 1957/58 season. Swaziland's contribution to this achievement was 7236 tons. The Union Industry alone produced 1,128,187 tons of sugar from 10,256,776 tons of cane, giving a cane/sugar ratio of 9·09. The quantity allocated to meet the requirements of the domestic market is 784,075 tons, leaving a surplus of 351,348 tons available for export. Of this quantity 238,831 tons have been exported in fulfilment of 1958 quotas under the Commonwealth Sugar Agreement and International Sugar Agreement and the balance of 112,517 tons will be disposed of against 1959 quotas. Countries to which sugar was exported included the United Kingdom, Rhodesia, Kenya, Nyasaland, Malaya, Zanzibar and Korea.

Domestic market sales to 28th February total 611,818 tons, made up of 463,509 tons of white sugar, 132,700 tons Two Grade sugar and 15,609 tons centrifugal sugar.

With another huge crop anticipated next season, several mills will have re-opened in April with the remainder in production some time during May.

* * *

The International Sugar Council and the Sugar Price.

The International Sugar Council still feels that, on straightforward supply-demand considerations, the recent low sugar prices have not been justified, Mr. ERIC ROLL, executive director of the Council, said at a Press conference in London last month.

Mr. ROLL said that, in his view, other factors, particularly the uncertainty about the political position in Cuba, had been at work in the market.

The Council, Mr. ROLL continued, had been absolutely right not to rush into further action when the market did not respond to its export cuts in February, though there were still a number of weapons at its disposal.

The Council wanted to make 100% sure exactly what the present situation required. For this reason the executive committee has sent Mr. ROLL on a tour of member countries to hear their views and to make an assessment of the sugar position.

Mr. ROLL said that he had just completed the European part of his tour. He would shortly cross the Atlantic and would visit a number of countries there, including Cuba and the U.S. He would then report back to the executive committee, probably some time in the second half of May, and it will then be decided what action to recommend.

* * *

American Sugar Refining Company 1958 Report.

Raw sugar melted in 1958 totalled 1,912,019 short tons compared with 1,815,544 tons in the previous year. Net sales were up from $323·9 million to $342·7 million. Expenditure on additions and improvement to plant and equipment were $12,183,688 for U.S. domestic operations and $1,146,284 for Cuban operations. These compare with a total of $11,067,633 in 1957. During 1958 substantial progress was made on two major bulk handling projects: at the Baltimore refinery, construction of a wharf extension permitted installation of two large gantry cranes (shown in the report) which remove raw sugar from ships' holds by grab and place it on belt conveyors which carry it first to automatic weighing and sampling devices and then into the warehouse. Existing warehouse facilities, originally designed for bagged sugar have been converted for receiving bulk raws. In addition, work is nearing completion at the Brooklyn refinery to permit bulk conveying and storage for raw sugar received in bags.

Packaging departments have been improved, including air-conditioning at the New Orleans refinery. The new Chicago warehouse and liquid sugar plant was completed in June 1968. High-speed automatic centrifugals and new vacuum pans have been installed as replacements and a new 10-machine affination battery at Philadelphia is illustrated. Also shown is a series of specially designed delivery equipment for industrial consumers which includes a pneumatic "blower" truck for bulk dry sugar; a rail tank car for liquid sugar, a rail "hopper" car for bulk dry sugar, a road tanker for liquid sugar, and a bin truck for bulk dry sugar.

The Company's Cuban Mills, Centrals Cunagua and Jaronú, produced 1,766,900 bags of 250 Spanish

[1] *S. African Sugar J.*, 1959, **43**, 319.

pounds each, compared with 1,615,179 bags of raws in 1957. In addition they made 3,141,000 gallons of high-test molasses. Cane supply was ample, unlike the previous year when the crop was reduced by drought.

* * *

Bulk Shipment of Raw Sugar from Puerto Rico[1].

During 1958 the entire movement of raw sugar from Puerto Rico was in bulk, eliminating the use of bags from all stages of storage and transportation within and from the island. Thus Puerto Rico is one of the first areas equipped to move its entire production by this modern method. Consequently, the variety of physical facilities and organizational arrangements used to accomplish this broad gauged technological change hold special interest.

Both refiners and raw sugar producers have long recognized that economies were possible through bulk handling of raw sugar. Commercial bulk sugar shipments from Cuba to the United States began in 1932 and from Hawaii in 1942. Bulk operations from Hawaii reached major proportions immediately after the war and were all inclusive by 1954, but bulk shipments to the U.S. of sugar from Cuba were about 11% of total shipments as late as 1957, expanding abruptly to 25% in 1958 when bulk supplies from Hawaii were sharply reduced.

The shipping of raw sugar in bulk from Puerto Rico began in 1947 when Central Aguirre Sugar Company experimented with bulk shipping by opening and dumping bags of sugar into the holds of a ship. They shipped approximately 11,000 tons of sugar in 1947 by this method. During the next few years improvements were made in bulk loading facilities and the amount of sugar handled in bulk increased yearly.

Table I. Bulk Shipments of Raw Sugar from Puerto Rico to U.S. Mainland.

Crop year ending	*Bulk Terminals.*					*Bulk as a percentage of total shipments*
	San Juan	*Aquadilla*	*Guánica*	*Aguirre*	*Total*	
	1000 short tons, raw value					
1954				130	130	14
1955			74	168	242	25
1956			133	211	344	30
1957	118		256	227	601	78
1958	250	128	162	156	696	100

With bulk terminals now in operation at southwest, southeast, northwest and northeast ports all of the raw sugar mills are within 50 miles of such facilities. Formerly some processors transported raw sugar to bulk facilities as much as 85 miles from their mills. The average distance of the mills from the terminals is about 25 miles, but since a large part of the crop is produced nearer the terminals the average distance per ton of sugar delivered is about 15 miles. During 1959 it is expected that about two-thirds of the Island's sugar will be shipped from terminals on the north coast. A larger portion of this sugar will be shipped from San Juan than from the most recently completed terminal at Aguadilla.

The capital investment in the four terminals totals approximately 4·8 million dollars—the investment per terminal varying widely because of differences in type and time of installation and the use at San Juan of a rented warehouse. The services furnished by these terminals include weighing, receiving, testing, handling in and out of warehouse and loading on ship.

For these services the charges during 1958 averaged about $2·55 per ton of sugar. The terminal at Guánica provided storage and special handling at additional charge. Both Aguirre and Guánica have a large warehouse capacity for raw sugar since the bulk terminal operations began as an adjunct to their own processing facilities. Both the San Juan and Aguadilla terminals were established for the sole purpose of loading sugar. Raw sugar mills using these facilities would necessarily store their sugar at the point of production.

* * *

West Indies Sugar Co. Ltd., 1958 Report.

Sugar production at Monymsuk in 1958 was 50,712 tons and at Frome was 77,959 tons, a total of 128,671 tons, compared with 143,203 tons in 1957. Trading profit was reduced from £838,510 to £342,844 and net profit from £650,785 to £284,307.

This severe drop is only partly due to world prices having returned to normal in 1958. A much more important factor is concerned with agricultural operations at Monymusk. Four or five years ago there was every indication that Jamaica was overproducing. It fell to Monymusk to reduce its sugar output by planting bananas. But the over-production did not materialise; indeed there was a call for every ton of sugar that could be produced. Within certain limits harvesting of cane can be continued in one year at the expense of the following year. That is what has been happening at Monymusk in order to fill the demand for sugar, and cropping has got further and further out of step with the seasons. This state of affairs was seriously aggravated by the 1957 strike, and it became clear that sooner or later immediate production would have to be sacrificed in order to restore the proper growth cycle. Weather conditions made it advisable to do so last year. Production will be considerably higher in 1959 and will continue to expand in the following years.

Under the terms of the new International Sugar Agreement, the sugar exporting territories of the Commonwealth collectively undertake to limit their exports to 2,500,000 tons in 1959 and to 2,575,000 tons in 1960 and 1961. This modest increase is well within the capacity of the industry and considerably less than the expected rise in the requirements of importing Commonwealth countries. Thus the Commonwealth exporters have made a significant sacrifice in the interests of obtaining the signatures of Brazil and Peru to the Agreement and it is hoped that thereby sugar markets will become more stable.

[1] U.S.D.A. Sugar Rept., March 1959, (83).

PRINCIPLES AND PRACTICE FOR THE CONTROL OF EELWORM DISEASES

By JOHN GRAINGER

(Department of Plant Pathology, West of Scotland Agricultural College, Auchincruive, Ayr, Scotland.)

PART II.

Soil injection. Certain volatile liquids, when introduced at intervals within the soil, give off vapour which spreads through the whole mass and controls eelworm thereby. A constant head gravity-fed toolbar-mounted soil injector‡ was developed for the process (fig. 4) and lays continuous traces of the liquid 4 inches or 6 inches deep in the soil. The aim is quite different

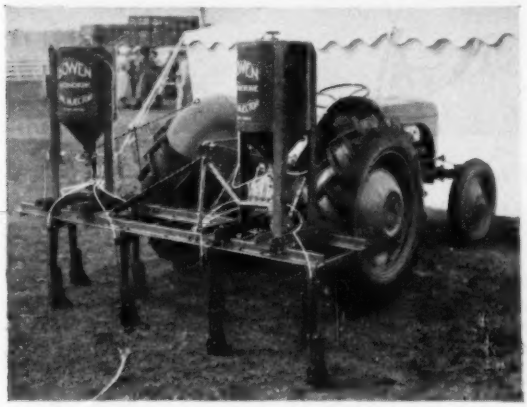

Fig. 4. Two units of the "Auchincruive" injector mounted on a cultivator toolbar.

from that of intimate soil mixing, for best performance is given when (within limits) the more liquid is concentrated in one place. Thus injections of the same amount per acre give better performance in disease control when the injection tines are spaced 12 inches apart than at 9 inches, and one small experiment gave the best results of all at 17 inch spacing of the tines. It would be logical from this to assume that placing the liquid in spots would be even better, and several types of "blobber" (interrupted flow injector) have been tried. They gave good results only on some soils, however, and cannot yet be recommended wholeheartedly as an improvement on the wider spacings of continuous injection. Ground should be harrowed and rolled immediately after injection in warm areas, to seal in the liquid, and the cost of the application itself lies between £2 and £3 per acre.

There is now quite a choice of liquids suitable for soil injection. D.D. (dichloropropane-dichloropropylene mixture) is widely available. It costs something like £23 per acre for an application at 200 lb though it can be applied up to, but not above, double this rate, with performance improving *pro rata.* D.D. is phytotoxic to plants immediately after treatment, but when residues in the soil are lower, the yields of many crops, even those growing in healthy soil, are improved. Our work on field control of potato root eelworm gave about 55% reduction in the eelworm population, but fig. 5 shows that far better performance is to be expected in warmer soils.

Ethylene dibromide (E.D.B.) is probably very similar in performance and present price to D.D. "Nemagon" (1,2-dibromo-3-chloropropane) gave but poor performance in Scotland; it is, however, stated to be at its best with soil temperatures between 50 and 80°F, so it may well prove better with warmer climates in cane-growing countries. Chloropicrin has also been used with success on high-value crops, and "Vapam" (sodium methyl dithiocarbamate) is also a new (though not yet cheap) soil nemacide, fungicide and weedkiller. It gave rather low performance when injected outside in Scotland, but may, however, work better when applied as a soil drench under glasshouse conditions.

Soil drenches are perhaps most useful in glasshouse practice where the relative crop value is very high. They are, however, particularly useful in treating the upper layers of the soil mass, as opposed to the actual

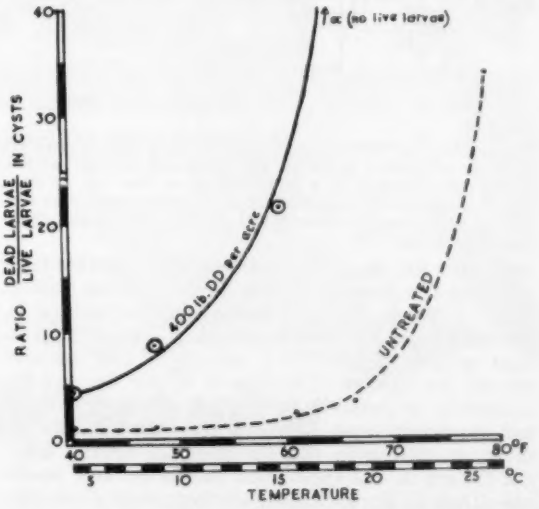

Fig. 5. The performance of D.D. in killing larvae of *Heterodera rostochiensis* improves with increasing temperature. Natural wastage of the larval population is also greatest at the higher temperatures (the "untreated" graph line).

‡ The soil injector is made as units, attachable to a cultivator toolbar (2) or plough (1), by Messrs. James Bowen & Sons Ltd., 45–59 Pitt Street, Edinburgh, Scotland—Ed.

surface (see below), and therefore combine well with other methods as will be discussed later in this paper. They arose out of a finding by STANILAND that chemicals of the phenol-xylenol range could be "solubilised" by controlled treatment with certain detergents[9]. Solubilised xylenol is the most practical ; the liquid as prepared is generally diluted 1 to 100 with water, and this solution is watered on the soil at the rate of about 2 gallons per square yard, before a crop is grown. Material costs are high (about £55 per acre) and so are the labour costs for preparation and application (about £20–25 per acre). The method would also be limited in practice by the availability of water ; it is not really a field control, but might be used on small plots.

Surface treatments are necessary for surface eelworms such as *Ditylenchus dipsaci* on oats ("tulip root"). Soil injection with D.D. gave absolutely no control of this eelworm disease, but when the D.D. was sprayed on the surface and *lightly* raked, the amount of disease was diminished. D.D. was too expensive for the low-value oat crop, but 50 gallons per acre of a 1 : 1000 aqueous solution of mercuric chloride, sprayed evenly over the soil surface and then lightly worked into the surface, provided a fully economic control for light infestations[10]. The spraying can be done by a medium-volume sprayer provided with fan jets mounted in unions so that the fans can be adjusted all in line, and so that they just meet at the soil surface (fig. 6). Bray gas regulator "O" jets

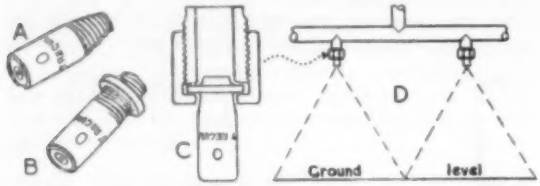

Fig. 6. Machinery for surface treatment. A, a "Bray Regulator 0" jet as obtained ; B, with a mounting ring soldered to the thread ; C, mounted in a union fitting, so that the jet fans can all be adusted in one plane, as in D, which also shows the correct adjustment of boom height so that the fans just meet at ground level.

were used for the work, and they form suitable fans of liquid at a pressure of only 2 p.s.i. Surface mixing is very necessary (the spray does not control without it) and can be accomplished by dragging links of chain or light weights (fig. 7) or a *very* light seed harrow behind the sprayer. The aim is to stir the soil as intimately as possible but only at the very surface, and treatment must be given after the oat seed is sown, so that even the operation of sowing does not disturb it. An application should not cost much more than £1 per acre, and, when given to a suitably low eelworm population, it should bring a ratio of cost to benefit to 1 to 4.

Combined treatments

The approximate relative spheres of action of the four systems of control may be visualised from fig. 8. Soil injection with D.D. has excellent penetration in depth but is relatively low in performance at the surface. Soil drenches, on the other hand, give excellent control at the surface, but not to a great depth. The two methods have been combined with advantage, to give about 97% control of the tomato root-known eelworm *Meloidogyne* sp. in glasshouses. Combined treatment costs about £150 per acre, comparing favourably in this sitting with £400 per

Fig. 7. A series of light weights for surface mixing.

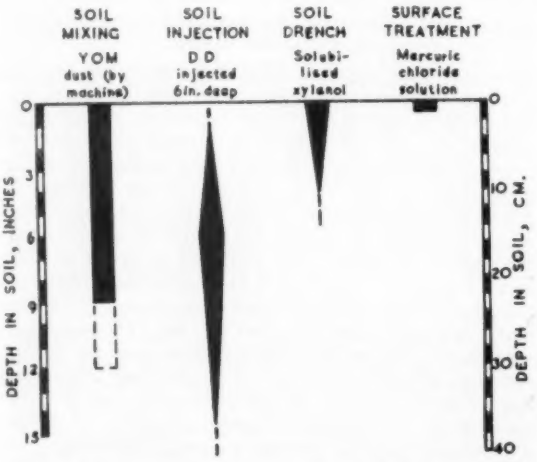

Fig. 8. A purely illustrative diagram to suggest the approximate relative spheres of action of control systems for eelworm disease.

[9] STANILAND and STONE : "Solubilised chemicals for the control of plant nematodes". *Nature*, 1952, **169**, 420.
[10] GRAINGER : "The control of *Ditylenchus dipsaci* on oats". *Nematologica*, 1956, **1**, 277–282.

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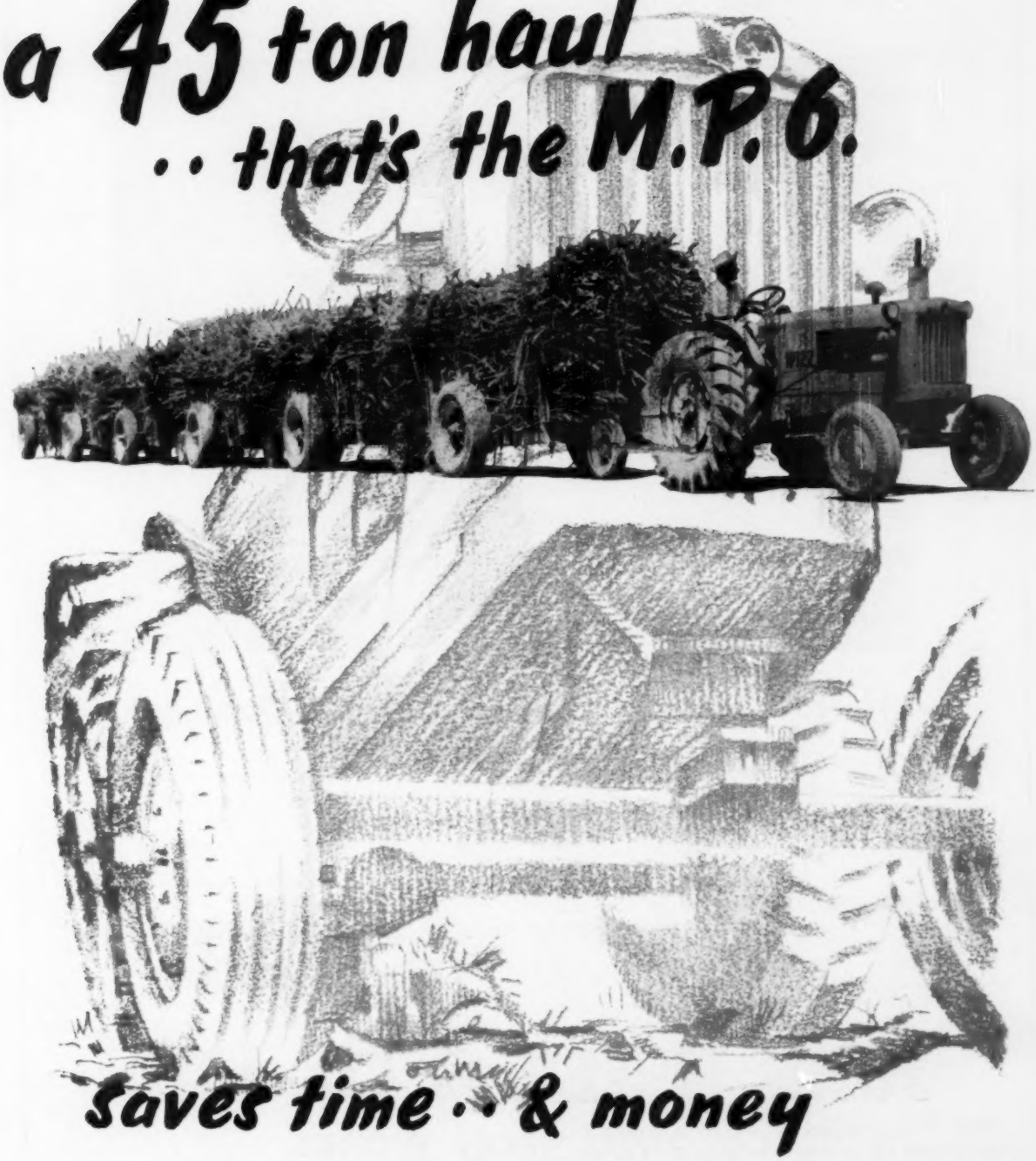

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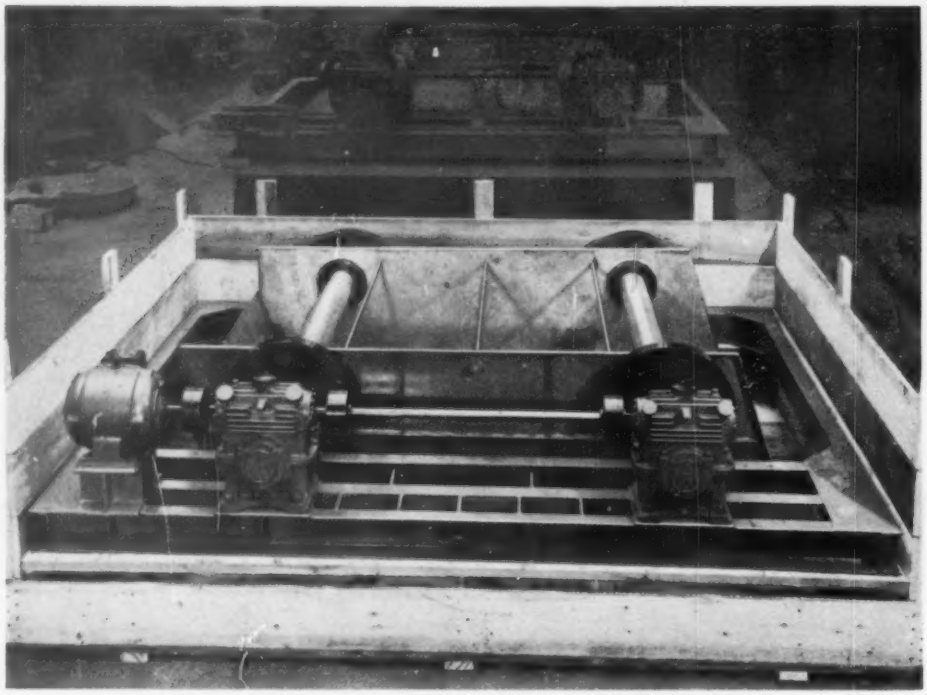

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acre for steam sterilisation, and being suitable for the glasshouse tomato crop which is worth about £5,000 per acre.

Should treatment to a considerable depth in the soil become necessary as a field treatment for sugar cane, the method of soil mixing could be adjusted to work at about 12 inches deep if ground could first be ploughed to this depth, and the cost for material would rise to something like £13 or £14 per acre. If the ground could not be ploughed so deeply, but a deep, high percentage control were still necessary, a combination of soil injection with shallow soil mixing would be most likely to give the best results, though the cost would be in the neighbourhood of £30 per acre. Pure surface treatments would not combine well with other systems.

Possible Combinations with Treatments for other Diseases

It would always be valuable if treatments which control more than one disease could be given. Benzene hexachloride (BHC) is a material already used on a large scale in Australia to control the Greyback and "Frenchi" grubs which attack the roots. This material has indeed been tried against potato root eelworm as a one per cent dust which delivered 6 lb BHC per acre, but unfortunately it gave no control. D.D. has been stated to control wireworm and "Vapam" to control fungi and weeds whilst soil mixing with mercury dust controls certain fungal and bacterial diseases in addition to eelworm. There is thus a possiblity of controlling more than one kind of damage though it is only of very limited application at present.

Consecutive Treatments

Can a total, 100% control of an eelworm disease be obtained? The best percentage control from a single field treatment against potato root eelworm in the cool temperature region of Scotland is the 75% of machine soil mixing. Combined treatments of D.D. and solubilised xylenol raised the percentage to 97 under glasshouse conditions, but there appear to be still better possibilities from consecutive annual applications. The first of a series of consecutive treatments *must* bring the eelworm population into the unshaded area of fig. 1, for only then will subsequent applications reduce the population still further. Thus, taking the 75% reduction brought by soil mixing against the potato root eelworm we get a series like the following :—

Treatment (years)	1	2	3	4
% reduction of eelworm population in relation to untreated control	75	92	98	99·5
Actual population, equivalent to cysts with contents per gram of soil	0·3	0·096	0·025	0·006

When the population falls below 0·02 cysts with contents per gram of soil, the chances of noticeable disease occurring are greatly diminished, so that four consecutive treatments, even on four consecutive potato crops could be expected to bring something like practical elimination of the disease. The combined ratio of cost to benefit of all four treatments would be 1 to 3½, which is economically tempting.

An even better combination, where it is feasible, would be to space the first two consecutive treatments by a seven-year rotation on crops other than potatoes. By the time the third potato crop became due, the population would be at the level shown above for the fourth consecutive treatment. This is a fascinating consequence of treatment, and similar possibilities should be considered whenever any plan of control is being formulated. They would not apply directly to established sugar plantations but might be very useful as, for example, the preliminary treatment of ground infested with *Meloidogyne* before being planted with sugar cane.

Eelworms are relatively primitive organisms but are usually well adapted to their environment. The task of control demands no less adaptation on the part of the grower, and it has been shown that the armoury against these devastating parasites is not by any means so empty as it was only a decade ago.

AGRICULTURAL ABSTRACTS

Sugar Cane Variety Experiments in the Victorias District, 1956/57–1957/58. F. T. TABAYOYONG and I. P. FERRARIS. *Sugar News* (Philippines), 1958, **34,** 403–407.—The results of 33 trials with 36 commercial canes are recorded. Of these, Co 440, Co 449, CP 29/116, H 37–3633 and N:Co 310 are the most promising and have outyielded POJ 3016, a cane which took the place of H 37-1933 as leading variety only in 1957. Previous leading varieties have been POJ 2878 from the early thirties to 1948, and POJ 2883 from 1950 to 1952.

* * *

Tillage and the Control of Organic Matter. E. L. GREACEN. *Soils and Fertilizers,* 1958, **21,** 339–343.—The article reviews recent work on the rôle of organic matter in maintaining soil fertility as affected by different systems of tillage, clean cultivation as opposed to pasture, and monoculture. This rôle is considered primarily as affecting the physical properties of the soil and, in this matter, the effect of compaction through traffic and hoof pressures of grazing animals.

* * *

The Behaviour during Manufacture of some Varieties of Cane in the Province of Tucumán. R. FERNÁNDEZ DE ULLIVARRI and C. M. GUERINEAU. *Rev. Indust. Agric.* (Tucumán), 1957, **41,** (2), 2–27.—The data given cover the 1956–57 plant and ratoon crop of a large number of varieties grown at five stations and record juice qualities at intervals between mid-May and late August. The objective is to determine which varieties are best adapted to the different regional conditions.

SUGAR CANE AGRICULTURE IN AUSTRALIA

TWENTY FIFTH CONFERENCE, QUEENSLAND SOCIETY OF SUGAR CANE TECHNOLOGISTS, 1958

THE bulk of the labours of the Queensland Society's Conference was devoted to problems of administration and manufacture ; agriculture received relatively little attention.

In adopting cultural processes the planter has not an entirely free hand. Optimal conditions for cutting, land preparation and planting, for instance, may form a succession which does not permit satisfactory work with the available labour force and resultant stands may be poor. The central district of Queensland affords an example and, apart from the Burdekin area, a concomitant feature is the high percentage of plant cane, averaging, in the last 3 years, 42·2% of the cropped area. The subject is discussed by S. GREENAWAY who concludes that better results would be obtained at lower costs by adopting as standard practice the growth of two ratoon crops.

The soils of the Mackay district consist of badly drained, heavy, black clay loam, readily compacted and, therefore, to be cultivated with the minimum of working. Under these conditions, bagasse has been found to be a valuable asset, even to the extent of a blanket 1 ft in depth, when ploughed under. Experience of its use, described by C. G. STOREY, indicates that it is superior to green manure owing to its high content of slowly decomposing lignin and that it must be applied some time (up to 9 months) before planting or be accompanied by a nitrogenous dressing. Cultural details are also decribed. The same problem of the Mackay district is discussed by C. G. BIESKE from a different angle ; that of natural status. Much has been done in producing varieties well adapted to the local conditions but they cannot develop their potentialities to the full under the limitations of adverse conditions. The adjustment required in terms of fertilizer are considered in association with the use of bagasse as described above.

Varieties and Breeding

Q 50 first appeared in milling records in 1947 and by 1950, had become the dominant variety in the Mackay-Proserpine district, while in, 1955, it formed 85·6% of the State crop. The position created some anxiety since it was susceptible to red rot late in the season. This dependence on a single variety is a thing of the past and the number of approved varieties now available, including the latest additions, Q 56, Q 63, and Q 65, with their main characteristics, forms the subject of a paper by R. W. MUNGOMERY. A more detailed account of the breeding work is given by J. H. BUZACOTT, a feature of which is the manner in which locally bred varieties are assuming the position of parents.

Cane Diseases

A single paper by C. G. HUGHES gives a brief review of the history and present position of the diseases of the central Queensland region embracing the districts of Plane Creek, Mackay and Proserpine.

H.M.-L.

AGRICULTURAL ABSTRACTS

Conversion of Rail to Road Transport. ANON. *Cane Transport News*, 1959, **2**, 2 & 4.—Lihue, Kauai, is the last Hawaiian plantation to make this conversion. The reasons for the change and the new system are described by the Manager, K. B. TESTER, in an interview.

* * *

The Unit System—A New Concept in Cane Transport. E. C. WATT. *Cane Transport News*, 1959, **2**, 3–4.—The system depends on a new track-laying field power unit for handling semi-trailers in the fields and a new semi-trailer hydraulic landing gear operated from the driver's cab. By separating the haulage unit from the trailer, a flexibility is obtained under which the readily disconnected, and relatively cheap semi-trailers can be used for storage.

* * *

Mechanization of Sugar Beet Growing. C. CULPIN. *Agriculture*, 1958, **65**, 430–435.—Latest developments in the application of mechanization to all operations from ploughing and subsoiling through drilling, thinning and inter-cultivation to harvesting are reviewed.

* * *

Strains of Sugar Cane Mosaic Virus in Louisiana. E. V. ABBOTT. *Sugar Bull.*, 1958, **37**, 49–51.—After a period when mosaic became almost forgotten through the spread of resistant varieties, a new outbreak has occurred, possibly a new strain or strain F. The risk is indicated by the fact that it can infest the ordinarily resistant CP 44–101.

* * *

Fire Ant Eradication Increases Damage by Borer. W. H. LONG *et al. Sugar Bull.*, 1958, **37**, 62.—Elimination of the fire ant, *Solenopsis saevissima* var *richteri*, by broadcasting 10% "Heptachlor" granules at 20 lb/acre, has been followed by a sharp increase of borer, presumably through suppression of predators. Efforts are being made to determine the particular predators.

RATE OF GROWTH OF SUCROSE CRYSTALS IN PURE SOLUTIONS.

By ANDREW VANHOOK, FRANCIS P. FEHLNER, EDWIN J. ROTH, RAYMOND A. ROUSSEAU, and W. ALEXANDER VANHOOK

(Chemistry Department, College of the Holy Cross, Worcester, Mass., U.S.A.)

SUMMARY

THE need for confirming and extending KUCHARENKO's table of crystallization velocities of pure sucrose solutions has been recognized for some time. The present work prolongs the temperature of measurements to 110°C, but does not increase the concentration range considerably since the determinations were curtailed by false grain formation at degrees of supersaturation in the neighbourhood of 1·2. Standard values appear feasible only below 50–60°C since the course of reaction begins to depend upon transport conditions above that level.

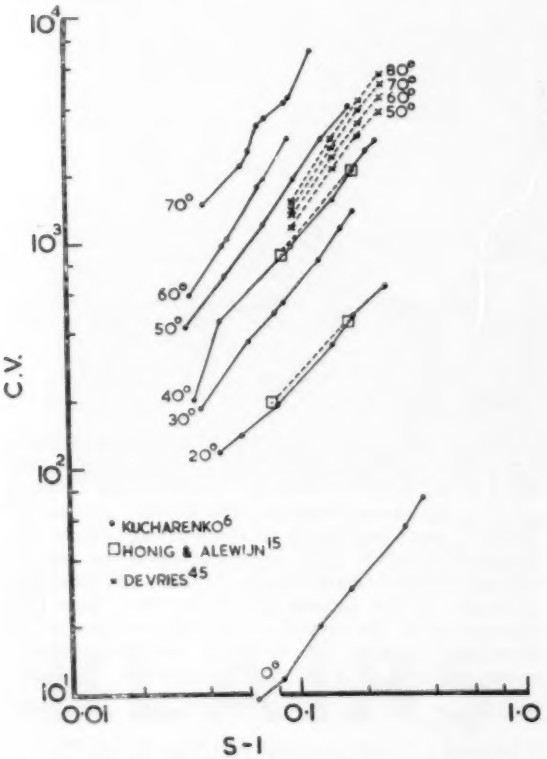

Fig. 1. Crystallization velocities of sucrose crystals in pure syrups.

$$S = \frac{\text{concentration as sucrose/water}}{\text{concentration as sucrose/water at saturation temperature}}$$

INTRODUCTION

The evaluation of the velocities of growth of sucrose crystals is a matter of obvious import ; yet existing values are questioned[1], especially in the ranges of concentration, temperature, and purity confronted in actual pan boiling. While considerable variation is to be expected respecting the last of these factors—and these continue to be investigated at the practical level[2,3,4], it remains desirable to confirm and extend the systematic values of KUCHARENKO which have been proposed as tentative standards for pure syrups[1,5].

KUCHARENKO's original data[6] are presented in point-to-point comparison in Fig. 1 and in Table 1. Supersaturations are employed in the figure to emphasize the essential unimolecularity of the reaction[7], and the double logarithmic scales conveniently compress the extensive range of values represented. HERZFELD's solubilities[8] have been used to compute the concentration term ; and while some of his values are recognized to be in error [1, 5, 9, 10, 11, 12, 13], the correction would not alter the form of the isotherms compared in the figure. These few comparisons are typical and suggest that there is no serious disagreement at ordinary temperatures[1, 5, 14, 15, 16, 17], but that KUCHARENKO's values are much too high at and above 50°C. The only consistent deviation from this pattern are the results of VERNON[18] which are

[1] *Proc. 11th Session ICUMSA* (Paris), 1954.
[2] "La Crystallization du Sucre". *Proc. Comm. Int. Tech. Sucr. Betterave* (Brussels), 1953.
[3] FOSTER *et al.*: *Proc. 24th Conf. Queensland Soc. Sugar Cane Tech.*, 1957, 223 ; *25th Conf.*, 179 ; *I.S.J.*, 1958, **60**, 79 ; 1959, **61**, 84.
[4] RORABAUGH and NORMAN : *J. Amer. Soc. Sugar Beet Tech.*, 1956, **9**, 238 ; *I.S.J.*, 1957, **59**, 257.
[5] *Proc. 12th Session ICUMSA* (Washington), 1958.
[6] *Planter and Sugar Manuf.*, 1928, **78**, (May-July).
[7] VANHOOK : *Ind. Eng. Chem.*, 1944, **36**, 1042 ; *I.S.J.*, 1945, **47**, 193.
[8] BATES *et al.*: "Polarimetry, Saccharimetry and the Sugars". *Nat. Bureau Standards Circular*, 1942, (C440).
[9] CHARLES AND MEADS : *Paper presented to the Amer. Chem. Soc.* (San Francisco), 1958.
[10] TAYLOR : *J. Chem. Soc.*, 1947, 1678 ; *I.S.J.*, 1948, **50**, 292.
[11] WISE : *J. Chem. Soc.*, 1955, 2714 ; *I.S.J.*, 1956, **58**, 159.
[12] WISE : *I.S.J.*, 1954, **56**, 69.
[13] WISE : Private Communication.
[14] DOSS and GHOSH : *Proc. 19th Conv. Sugar Tech. Assoc. India*, 1950, (II), 183 ; *I.S.J.*, 1952, **54**, 24.
[15] HONIG and ALEWIJN : *Mededeel. Proefsta. v.d. Java-Suikerind.*, 1930, 420.
[16] INGLEMAN : Socker, 1947, **3**, (1), 5 ; *I.S.J.*, 1947, **49**, 273.
[17] VANHOOK : *Proc. 24th Conv. Sugar Tech. Assoc. India*, 1955, 1 ; *I.S.J.*, 1957, **59**, 24.
[18] Ph.D. thesis (Univ. London), 1938.

higher than those of KUCHARENKO over the 30 to 60°C temperature range. However, VERNON's values are the maxima realized at high flow rates while the other results are all for relatively gentle stirring conditions. VERNON's values for no stirring are somewhat less than half the maxima and this reduction brings his determinations within the general trend.

In view of this situation the present investigation was pursued with the object of confirming and extending as far as possible, in a consistent way, the various values reported for the crystallization velocity of sucrose crystals in pure solutions.

METHODS

The adjustment of a supersaturated system may be ascertained from the actual increments of single crystals or from the change in composition of the mother liquor[1, 8]. The second procedure is the more convenient and rapid but suffers from the difficulty of ascertaining the constantly increasing crystal area[7, 17, 19, 20]. The progress of a single growing crystal may be evaluated from the change in weight or dimensions; the former being the one utilized by KUCHARENKO in his elaborate work. As practised by him and his followers, the crystals were removed from the syrup from time to time, wiped dry, and weighed. This entailed certain mechanical hazards which KUCHARENKO minimized by very careful preparation, selection, and handling of compact and well formed crystals. GRUT[21], somewhat later, showed that slightly etched crystals grew initially at velocities as much as 5–6 times the normal and required considerable time to assume constant values. This behaviour has been confirmed repeatedly in this laboratory, and even with unetched crystals in the present work. Initial fast growth is also accelerated and prolonged when the crystal is subjected to varying temperatures between periods of growth. It thus appears likely that the high values of KUCHARENKO may be due in large part to the practice of intermittent removal from solution and exposure to temperature changes.

These interruptions may be avoided by employing a buoyancy technique, which procedure was used by GERASIMENKO and GOLOVIN[23]. However, they reverted to the usual weighing operation in their later work[23, 24] presumably on account of the difficulty of agitating properly while the crystal was suspended from the quartz fibre balance. Substitution of direct microscopic determination of the dimensions of the crystal circumvents this trouble and also supplies intimate information regarding the morphology of the crystal.

Two different, very simple crystallizers were used in the present investigation. The first was an ordinary lipless beaker, ½ or 1 litre size, immersed in a water bath, and in which were mounted, through the closure, the crystal, agitator and/or circulator, thermometer or thermocouple, and sampler. The second type was an internally polished 1½ in pipe T the ends of which were closed with optical windows[11], and through the top of which were mounted the crystal and accessories. The temperature was maintained constant within 0·1°C by circulating thermostated oil through the surrounding jacket. A thin film of mineral oil impaired surface evaporation and formation of grain from this source.

Various natural and forced circulating devices[25] were improvised in an attempt to extend the concentration of measurements, but none were particularly successful in this regard. A supersaturation ratio of somewhat less than 1·2 appears to be the concentration at which false grain forms, except at 0°C where it is considerably higher. This point becomes apparent during the course of a determination with the appearance of scintillating centres long before discrete crystallites are evident. A change in the growth rate usually occurs at this time.

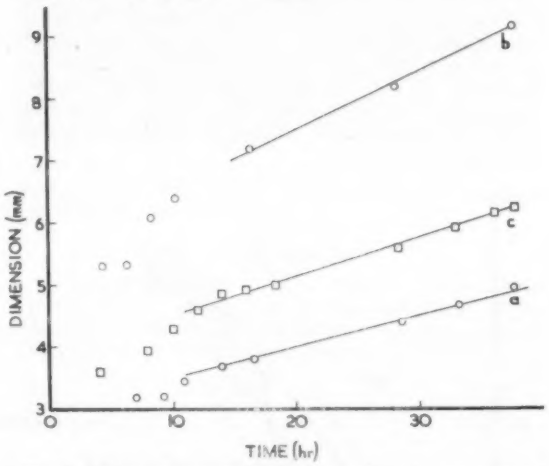

Fig. 2. Rate of growth of crystal surfaces in pure sucrose syrups. Typical run, 40°C, 7·55 m. Final crystal—a:b:c = 0·53 : 1 : 0·68.
$K = 83$; $\frac{3k_{gc}}{k_{1c}} = 0{\cdot}93 \times 10^6$. $\frac{da}{dt} : \frac{db}{dt} : \frac{dc}{dt} = 0{\cdot}53 : 1 : 0{\cdot}67$.
C.V. 989 mg/sq.m./min.

Seed crystals were attached to glass or wire supports by a spot of "Pliobond" cement. These were either fixed in position or attached directly to the rotating shaft in the axis of rotation. The growth rates below 50–60°C were indifferent to these arrangements but became dependent upon them and upon the rate of stirring at higher temperatures. Growth was measured in terms of the increments of the three principal dimensions of the crystal or its projected image, or from photographs. A Gaertner travelling microscope reading to 0·001 mm. determined the sizes.

[19] VANHOOK: *Ind. Eng. Chem.*, 1945, **37**, 782; *I.S.J.*, 1946, **48**, 245.
[20] VANHOOK: *J. Amer. Soc. Sugar Beet Tech.*, 1957, **9**, 590.
[21] Reference 2, p. 90.
[23] *Ukrain. Khim. Zhur.*, 1955, **21**, 27.
[23] *Ibid.*, 797.
[24] *Cukoripar*, 1956, **9**, 155.
[25] BUCKLEY: "Crystal Growth". (Wiley, New York). 1951. Chap. 2.

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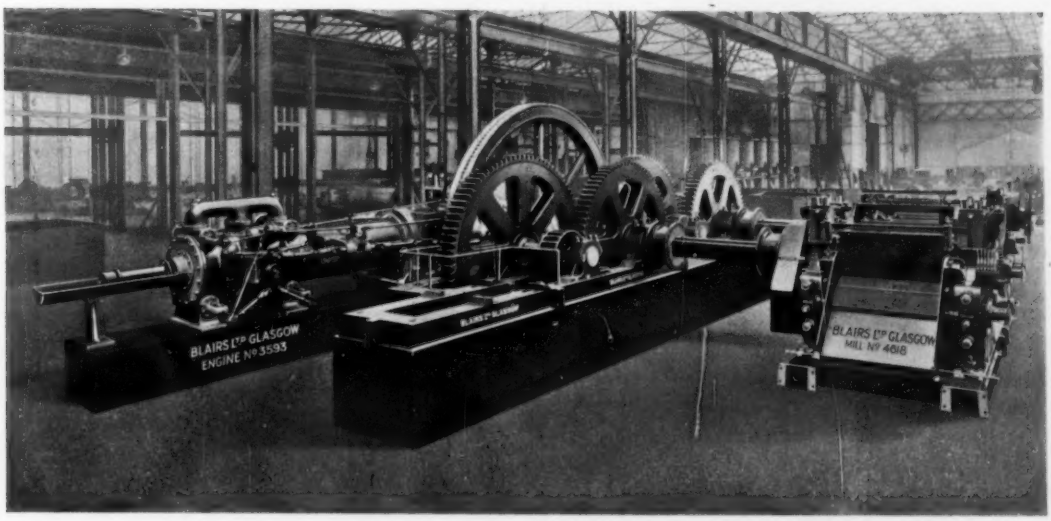

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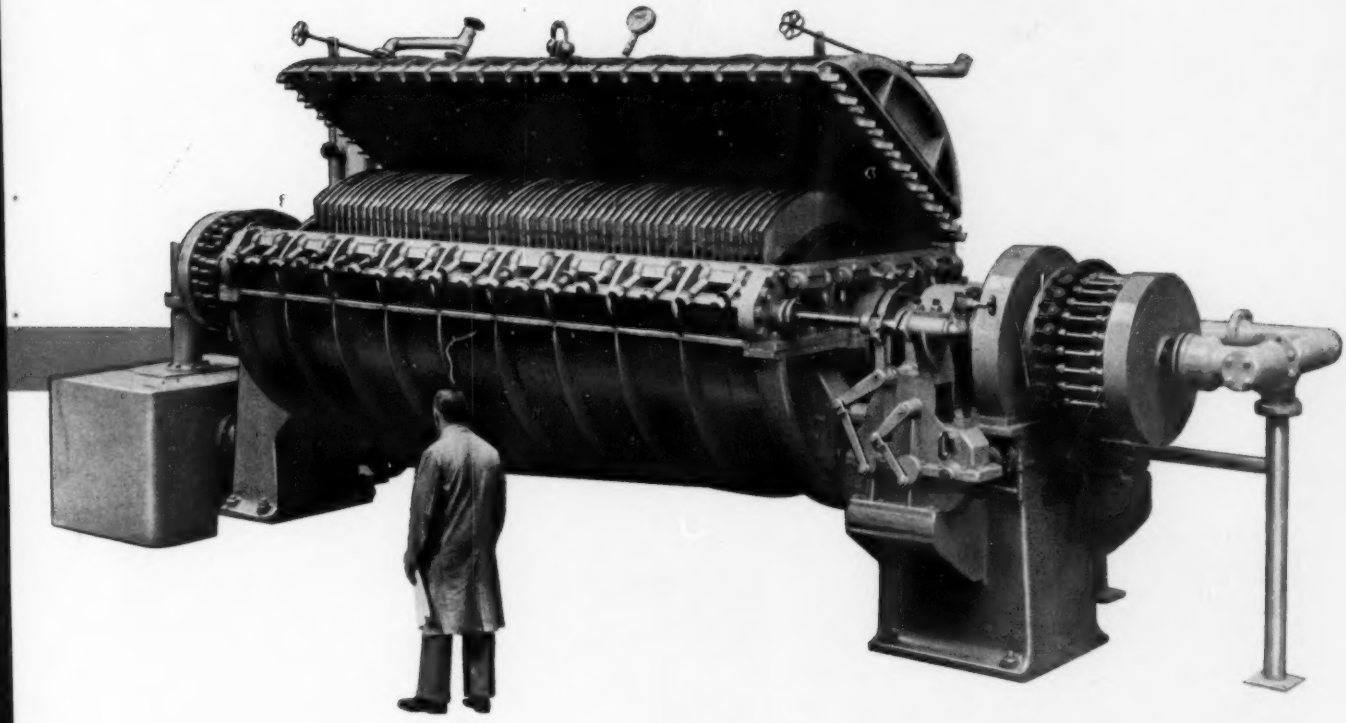

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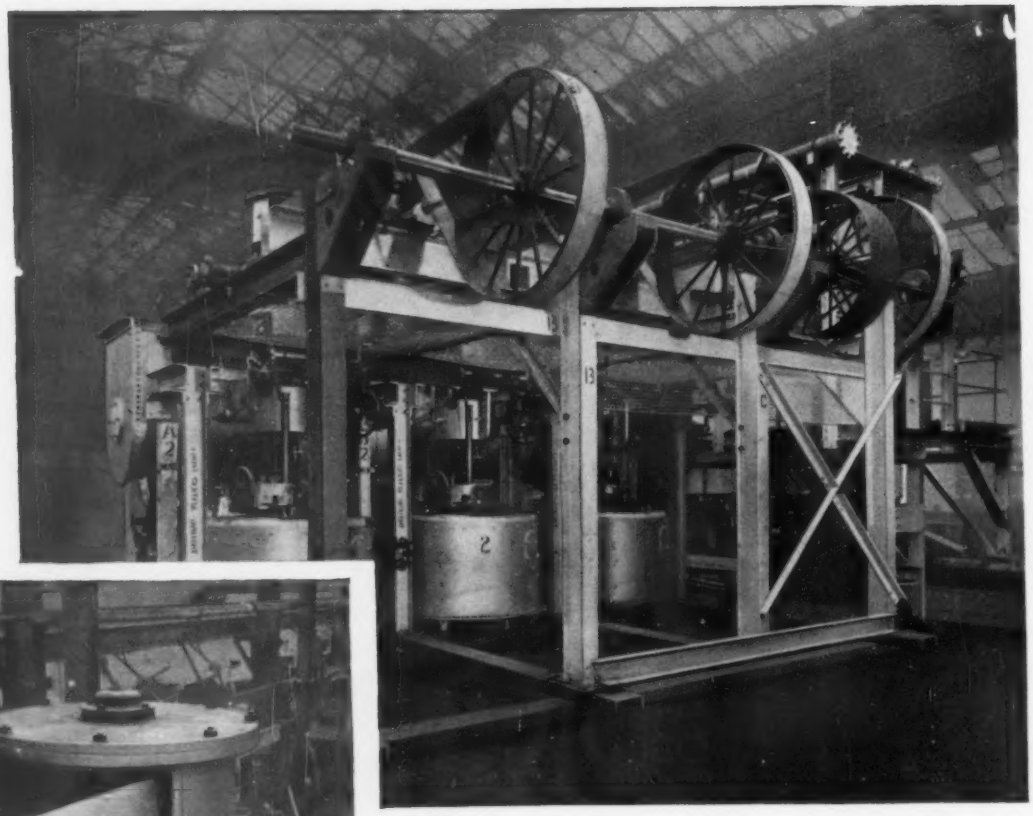

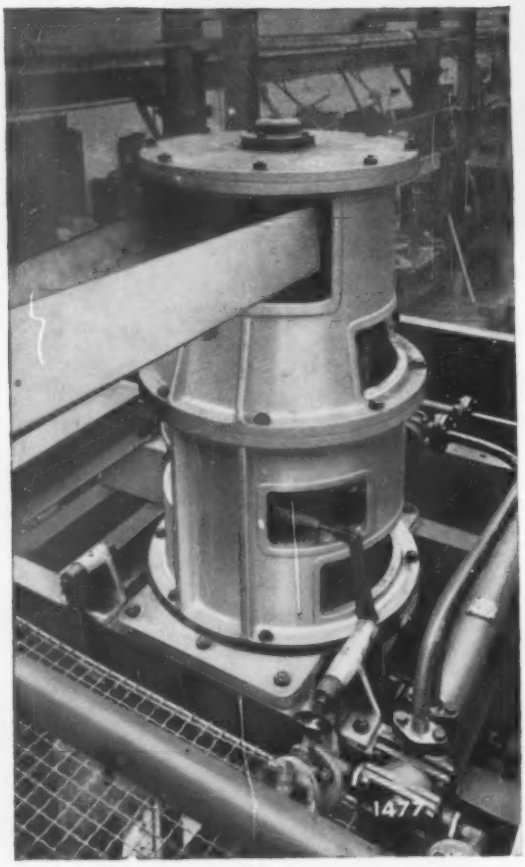

Belt Driven Centrifugals

These three 40 in. × 24 in. belt-driven centrifugals are designed to operate at top speed of 1,600 r.p.m. They are equipped with mechanical ploughs, and Fluidrive couplings ensure smooth pick-up at starting and a plough speed without clutch wear and tear.

Inset is a detailed view of the belt drive and Fluidrive coupling with oil cooler.

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Growth rates were taken as the slope of the dimension-time curve, such as illustrated in Fig. 2, after all three dimensions had assumed steady linear progress.

Uniform and reproducible results were obtained only when this condition of constant habit was established and considerable variation [26, 27, 28, 29, 30, 31] in growth rates could usually be associated with changing form and/or even minute variations or interruptions in otherwise constant operating conditions. This lack of reproducibility becomes more pronounced above 50°C, where the uncertainty is also aggravated by, and sensitive to, changes in stirring speed.

Materials

Confectioner's sanding sugar[9, 32] with an ash content of 0·002% and invert 0·003%, was used in most of the determinations. This material was surface inactive[33] and it was found later that other refined sugars gave the same results provided they also were surface inactive. Invert sugar was determined by the Baerts and Binard methylene blue test[34] and sucrose by refractometer using the International Sugar Tables[8], as recently modified[32, 35].

Calculations

The area A of any solid body of fixed shape is proportional to the square of a principal dimension, r, while the weight W is proportional to the cube of this dimension. Hence, $A^3/W^2 = \frac{(k_1)^3}{(k_2)^2} = K$; where k_1 and k_2 are the respective proportionality constants and K a characteristic shape factor. Kucharenko[1] fixed this constant at 69·93 (sq. cm.)^3 g^{-2} for sucrose crystals but there is ample evidence that this value is too low[16, 36, 37] and that it may vary from crystal to crystal according to the habit[38]. For this reason the particular values of this constant and related conversion factors were determined on the individual crystals used in the determinations, or upon crystals of exactly the same form. To convert linear increments to weight added per unit area the following relationship pertains:

$$\frac{dW/dt}{A} = 3\frac{k_2}{k_1}\frac{dr}{dt} = 3\left(\frac{k_2}{K}\right)^{\frac{1}{3}}\frac{dr}{dt}$$

Results

A consistent set of data is represented in Figs. 3 and 4, and the particular values of the lower temperature group are assembled in Table 2. The crystals studied in this entire set were suspended vertically from their truncated ends in the axis of rotation immediately between two ¾ in propellers. The upper blade thrust downward while the lower one circulated syrup upward. The entire assembly was rotated at 10 r.p.m. The results up to 50°C were virtually independent of the kind and speed of stirring, the position of mounting, size and shape of container, etc.; but above this temperature these variables became influential. Also, below about 50° the linearity of the curves was excellent to the limit shown and the results reproducible with different operators and in the two crystallizers. Deviations from linearity occurred at concentrations beyond those shown on the graphs

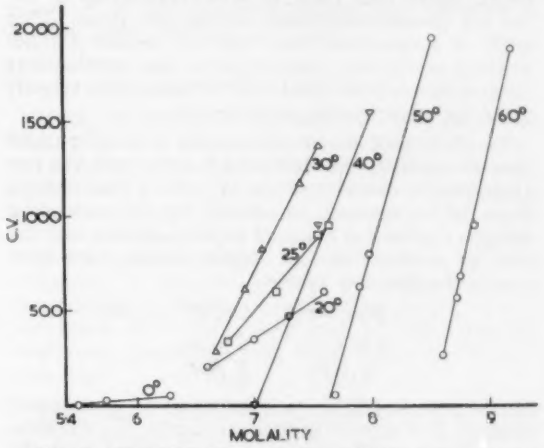

Fig. 3. Crystallization velocity—molality curves. Lower temperature group (10 r.p.m.)

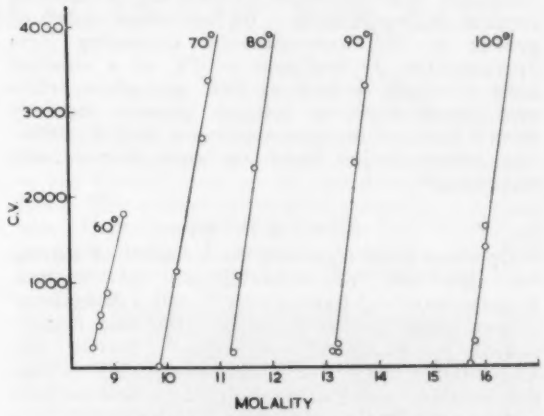

Fig. 4. Crystallization velocity—molality curves. Higher temperature group (10 r.p.m.)

[26] Albon and Dunning: *Nature*, 1957, **180**, 1348; *I.S.J.*, 1958, **60**, 372.
[27] Booth and Buckley: *Canad. J. Chem.*, 1955, **33**, 1155.
[28] Buckley: "Crystal Growth". (Wiley, New York.) 1951, p. 144.
[29] Honigman: *Zeit. Elektrochem.*, 1954, **58**, 322; 1957, **61**, 74; *Zeit. Krist.*, 1955, **106**, 3.
[30] Krueger and Miller: *J. Chem. Phys.*, 1953, **21**, 1018.
[31] Morris and Strickland-Constable: *Trans. Faraday Soc.*, 1954, **50**, 1378.
[32] Charles and Meads: *Anal. Chem.*, 1955, **27**, 373; *I.S.J.*, 1956, **58**, 201.
[33] O'Leary: B.S. thesis (College of the Holy Cross), 1957.
[34] Browne and Zerban: "Sugar Analysis" (Wiley, New York.) 1941.
[35] Snyder: *Nat. Bureau Standards Rpt.*, 1957, (5622).
[36] Bjerager: *Proc. 10th Congr. Int. Ind. Agric.* (Madrid), 1954; *I.S.J.*, 1955, **57**, 139.
[37] Drinnen: *Tech. Comm. Bureau Sugar Expt. Sta.*, 1938, (7).
[38] Thieme: *Facts about Sugar*, 1928; VanHook, *Ind. Sacc. Ital.*, 1958, **51**, 227.

and table and were almost always positive, fairly reproducible in the low temperature group, and corresponded with the occurence of secondary grain. The results agree with those of KUCHARENKO up to 50° but are considerably lower beyond this point. They differ in a consistent way with the results of other workers at elevated temperatures, thus emphasizing the complex dependence of the crystallization velocity upon the experimental arrangement.

The family of curves approaches a set of parallel lines above 60°C and this trend is continued in a few approximate determinations at 110°. This limiting slope is tantamount to identifying the activation energy of growth at constant supersaturation with the heat of solution at this higher temperature level since crystallization velocity

$$C.V. = k(m - m_s) = km_s(S - 1), \text{ and}$$

$$\frac{d \ln C.V.}{d(1/T)} = \frac{d \ln m_s}{d(1/T)}$$

where m = molality, m_s = molality of a saturated solution, S = supersaturation coefficient, T = temperature. These coefficients may be identified with the respective heat quantities according to the appropriate Arrhenius type equations. Graphical calculations confirm this speculation ; the activation energy of growth at 10% oversaturation decreasing from approximately 25 kcal/mole at 0°C to a constant level of about 8 kcal at 50°C and above, while uncorrected heats of solution increase regularly from 1 kcal at 0° to approximately 6 kcal at 100°C. This pattern is just about the same as previously recognized[39].

Effects of Stirring

Opinions differ regarding the influence of stirring on the rate of crystallization of sucrose. KUCHARENKO[6] and BARKHUYSEN[40] imply a dependence of one upon the other, which effect was demonstrated by SAVINOFF[41], AMAGASA[42], DAVIES and YEARWOOD[43], GOLOVIN and GERASIMENKO[24], DUBOURG and SAUNIER[24] and VERNON[15]. Most of these workers realized that the increase vanished at sufficiently high stirring speeds, but this same virtual independence was observed at even slow, ordinary degrees of agitation by DE VRIES[45], SILIN and SILINA[46], ZHVIRBLYANSKII *et al.*[47], HUNGERFORD[48, 49] and NAKHOMOVICH and ZELIKMAN[50]. This insensitiveness to agitation is expressed by low values of the exponent ($\beta < 0.25$) in the equation $C.V. = \alpha R^{\beta}$; where the stirring speed, R, extended from zero to supersonic rates[19, 20]. These experiments were performed at about room temperature, but a few at 60° and 80°C did not indicate any radical difference.

TABLE 1

Crystallization Velocity of Sucrose Crystals (mg/sq. m./min)
Comparison of Interpolated Results of Various Workers*

	40°C 8m	60°C 9m	70°C 10·2m	80°C 11·6m	90°C 13·2m
Kucharenko[6] ..	1570	1920	3700	—	—
De Vries[45] ..	—	1050	1350	1530	—
Honig & Alewijn[15] ..	1620	—	—	—	—
Gerasimenko & Golovin[22] ..	—	—	1875	2400	2700
Hungerford[48] ..	—	—	1700	—	—
Dubourg & Saunier[44]	—	—	(2400)	(4100)	(4000)
This work	1635	1300	1300	2100	(300)

* The first four employed the weighing procedure of Kucharenko, while the last three measured the growth lineally. Stirring conditions were comparable, excepting Dubourg and Saunier. These workers did not agitate during the growth measurements.

TABLE 2

Crystallization Velocity of Sucrose Crystals, Pure Syrups. Molality by R.I.; C.V. in mg/sq.m./min. Zero values by graphical extrapolation.

Temp. °C	m	C.V.
20·0	(6·01)	0
	6·56	198
	6·94	374
	7·3	455
	7·6	612
25·0	(6·17)	0
	6·73	326
	7·2	600
	7·51	900
	7·58	960
30·0	(6·37)	0
	6·60	268
	6·88	622
	7·03	866
	7·4	1180
	7·50	1390
40·0	(6·96)	0
	6·94	0
	7·25	472
	7·50	989
	7·9	1635
50·0	(7·54)	0
	7·60	90
	7·8	643
	7·9	800
	7·4	1940

TABLE 3

Effect of Stirring Speed

Speed (r.p.m.)	0	1	10	100	600	Avg.β	Max.β
Rel. C.V. 33·5°C	0·73	0·86	1	1·56	1·63	0·13	0·34
Rel. C.V. 70·0°C	0·53	0·72	1	1·32	3·05	0·27	0·47

[39] HONIG : "Principles of Sugar Technology" Vol. 2. (Elsevier New York.) 1959.
[40] *Chem. Weekblad*, 1947, **43**, 234.
[41] *Nauchimie Zapiski*, 1929, **7**, 416.
[42] *J. Chem. Soc. Japan*, 1933, **36**, 535 ; 1936, **39** (**Suppl.**), 263.
[43] *Trop. Agric.*, 1944, **21**, 43 ; *I.S.J.*, 1944, **46**, 238.
[44] *Bull. Soc. Chim.*, 1939, **6**, 1196.
[45] *Chem. Weekblad*, 1935, **32**, 361 ; 1947, **6**/7, 83 ; *I.S.J.*, 1935, **37**, 449.
[46] *Trudy Vor. Khim. Tekh. Inst.*, 1938, **1**, 3.
[47] Cited in ref. 22.
[48] *Proc. Amer. Soc. Sugar Beet Tech.*, 1942, **3**, 499 ; *I.S.J.*, 1944, **46**, 323.
[49] *Ind. Eng. Chem.*, 1936, **28**, 893 ; *I.S.J.*, 1937, **39**, 26.
[50] *Nauchimie Zapiski*, 1928, **6**, 32.
[51] DEDEK : Reference 2, p. 18.
[52] HONIG : "Principles of Sugar Technology", Vol. 1. (Elsevier, New York.) 1953.
[53] FRANK : *Disc. Faraday Soc.*, 1949, (5), 68, 184.

In the present investigation crystals were allowed to grow in approximately 10% oversaturated syrups at 33·5° and 70°C while being rotated at successively different speeds. Table 3 summarizes the result of a successful experiment, and intimates that stirring is not a primary factor[22, 23, 39] in the crystallization speed of sugar at 33·5°C, but becomes more important although still not dominating at the higher temperature.

Mechanism

The present results support earlier contentions[7, 17, 19, 20, 51, 52] that transport considerations are not primary factors in determining the rate of growth of sucrose crystals at low temperatures and from pure syrups. However, this factor begins to exert an influence above 50°C, according to the change in nature of the curves in this neighbourhood and the increasing effect of stirring speed. Under these circumstances the observed growth constant, K, may be expressed in terms of the transport and absolute growth rate constants, k_T and k_G, respectively, by

$$K = \frac{k_T \cdot k_G}{k_T + k_G}$$

Insufficient knowledge about the nature of these individual factors[21,53] is available to resolve the observed constant, although some intriguing speculations[13, 51] in this direction suggest that diffusion is already partly limiting at 60°C.

ACKNOWLEDGMENT

Much of the work reported above is from the M.S. theses of Messrs. ROTH and ROUSSEAU. Mr. E. C. GILLETT of the California and Hawaiian Refinery in Crockett, Calif., U.S.A., supplied a large quantity of the exceedingly pure sucrose consumed in this work. Mr. H. E. C. POWERS of Tate and Lyle, Ltd., London, England, made available specimens from his fine collection of sucrose crystals for the dimension measurements. Sugar crystallization studies at this institution have been supported in large part by continuing grants from the Sugar Research Foundation, Inc.

The authors wish to express their deepest gratitude to these several benefactors.

BULK HANDLING TERMINAL IN THE FAR EAST

THE first bulk-sugar handling terminal in the Far East, with a capital outlay of $2,150,000, was recently completed in the Philippines in time for the 1958–59 export season. Owned by the Luzon Stevedoring Corporation and operated by its subsidiary, the Visayan Stevedore-Transportation Co., the terminal is located in Guimaras Island, directly opposite Iloilo City in the central part of the Philippines. Construction of the Guimaras terminal was started in 1957 and completed in February 1959.

The introduction of these bulk-handling facilities places the Philippines in a competitive cost and selling position with Cuba, Australia and other sugar-exporting countries. In this respect, the Philippine sugar industry also expects to save considerable foreign exchange by cutting down on the importation of jute bags.

The choice of Guimaras Island as the site of the bulk-sugar terminal, after an exhaustive survey by local and foreign technicians in consultation with domestic sugar interests, was a happy one, since it would best serve the sugar-producing areas of Negros, Panay, Leyte, and Cebu. Guimaras affords a year-round shelter from typhoons. It has a deep-water port allowing adjacent shore storage. It is centrally located to the convenience of all main sugar producers in the region and has a suitable area for extensive warehousing.

The first shipment of bulk sugar through the Guimaras installation was made by the Hawaiian-Philippine Co. at Silay, Occidental Negros, amounting to 6,000 tons. The cargo was loaded on board the M/S "Victoria Maru", owned by the Mitsubishi Lines of Tokyo.

Before leaving the Hawaiian-Philippine central, the raw sugar is weighed mechanically and later carried by belt conveyor to a platform which delivers into specially constructed bulk railcars for transport to the Central dock at the mouth of Mambaguid River. The boxcars are emptied upon arrival through specially designed gates built in the floor of each car to a pit located underneath them (Fig. 1). Bulk sugar then moves onto a horizontal belt which loads

Fig. 1

each barge. When a barge is fully loaded with 350 tons of sugar, it is sealed securely and towed to the Guimaras terminal, some twenty six miles from Mambaguid.

At the Guimaras terminal (Fig. 2), the sugar-laden barges are placed under an unloading shed, which accommodates two barges at a time. (Fig. 3)

They are unloaded by grabs feeding conveyors and bucket elevators which deposit the sugar onto a conveyor through travelling hoppers straddling the belt. It is transferred to an inclined conveyor and thence into a hopper scale. After weighing it is carried by a bucket elevator to a loading-in platform at the top and extending the whole length of the warehouse.

The sugar falls onto another conveyor, which runs the entire length of the platform. A moveable "tripper" on rails, equipped with chutes on each side, travels from one end to the other of the loading-in platform and as the conveyor belt passes through it, throws the sugar from either side onto the warehouse floor below at the required point. These receiving facilities have a proven capacity of 300 long tons per hour.

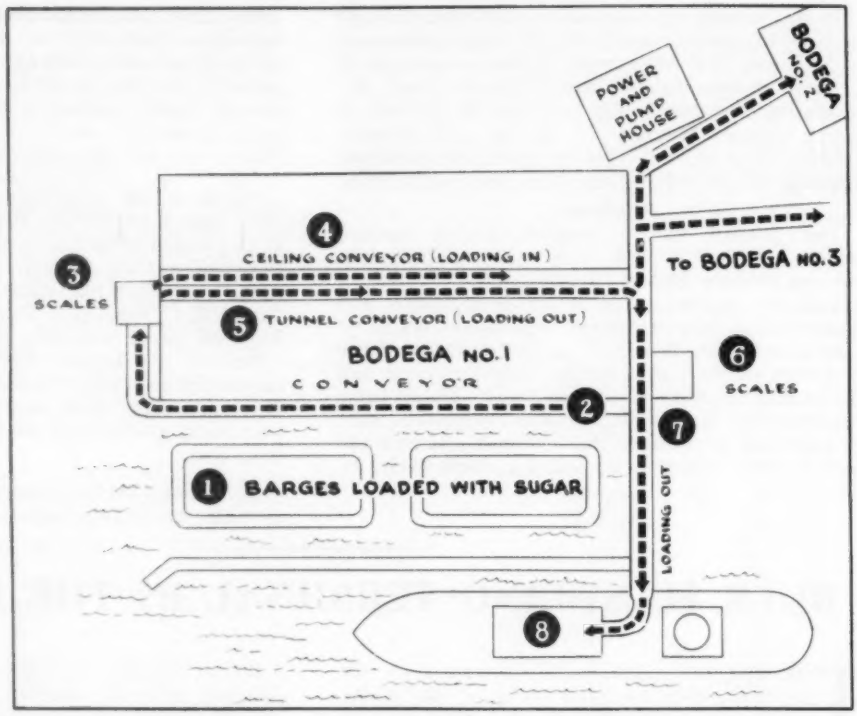

Fig. 2 Key : (1) Barge unloading dock; (2) Conveyor; (3) Ingoing sugar scale; (4) Ceiling conveyor; (5) Tunnel conveyor; (6) Outgoing sugar scale; (7) Discharging conveyor; (8) Cargo ship.

Sugar is loaded into an ocean vessel by opening the gates situated in a line along the centre of the warehouse floor. Sugar then drops onto an out-going conveyor which runs inside a tunnel under the gates. This discharging system has a capacity of 500 long tons per hour. The flow of sugar is determined by the size of the opening of the gate. This conveyor assembly deposits the sugar into two 20-ton weighing-scale hoppers.

From the scales, sugar is transported by belt conveyor to a loading-out platform over the vessel's

Fig. 3.

Fig. 4.

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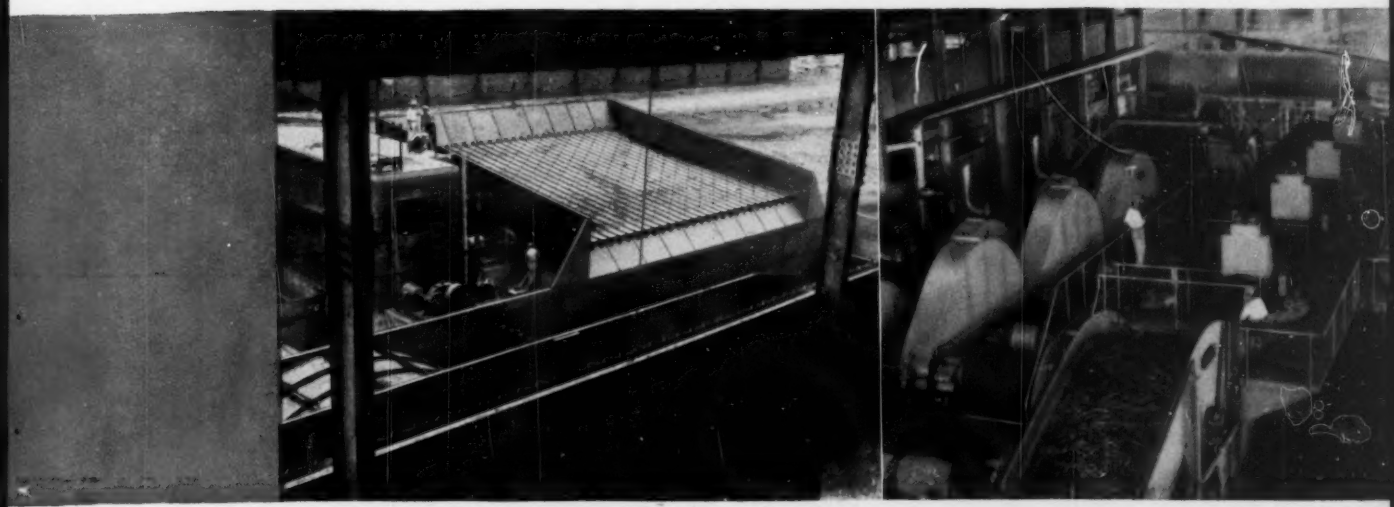

On location photographs of 5000 ton 36″ x 78″ milling tandem and cane handling equipment at Hacienda Pucala in Peru.

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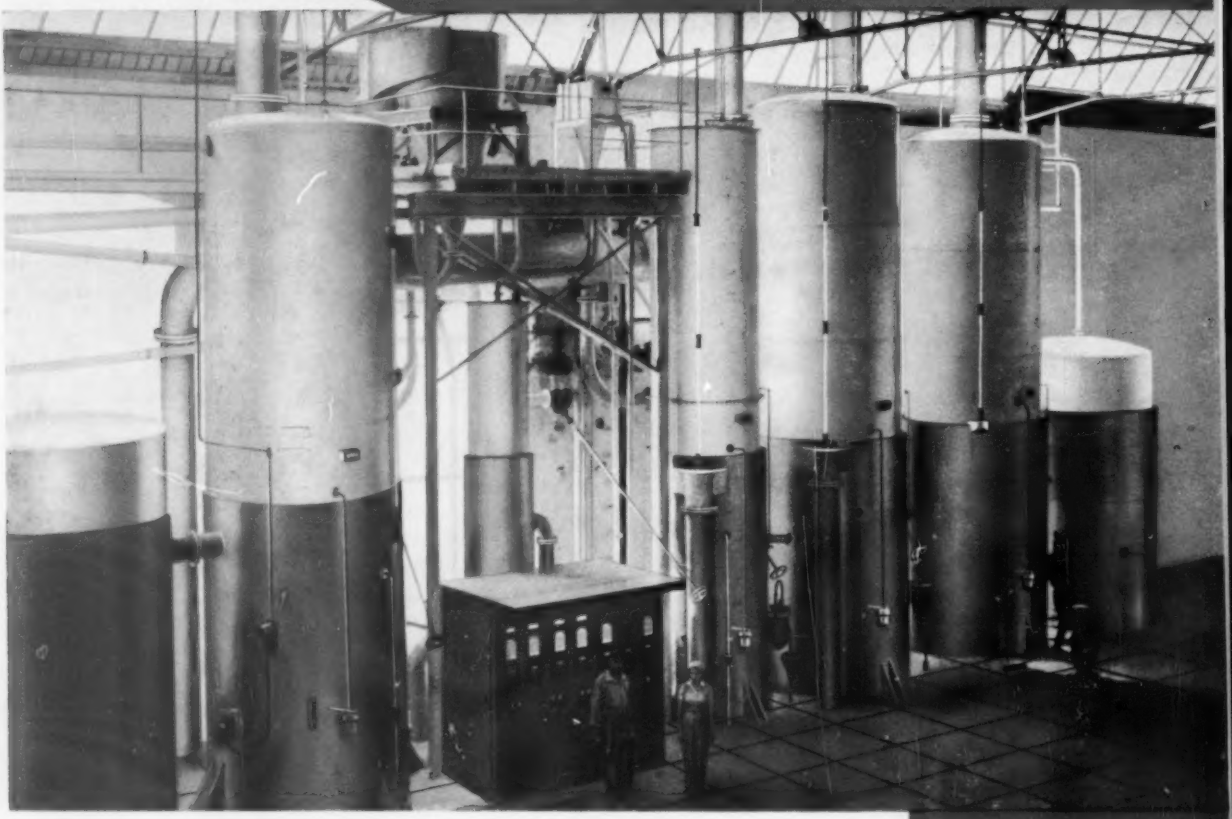

BRAUNSCHWEIG JUICE CLARIFICATION

Six plants were operating in Germany and elsewhere during the last campaign.

As a result of the economical operation of these plants we have already received 12 new orders for the 1959 campaign.

Characteristics of our juice purification plants are :

(a) Short juice retention in the decanter, amounting to only about 30 minutes owing to the high sedimentation speed.

(b) Especially favourable filtration coefficients, whereby a 2000-ton factory requires only one 25 sq.m. rotary filter for all the mud.

(c) High quality of juice (lime salts and juice colour) as shown below in figures obtained during the last campaign.

	Classical process 1957/58	*Braunschweig juice purification* 1958/59
CaO in thin juice	95 mg/100°Bx	72 mg/100°Bx
Thick juice colour	15·4°St/100°Bx	5·9°St/100°Bx

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hatch, the sugar flowing downward through an "elephant trunk", under which is a small "trimmer" which throws the sugar to any desired point in the hold, spreading the sugar evenly over the loading space (Fig. 4).

Vessels are adequately protected by pile fenders and there is ample water for large vessels to berth without running aground.

There are now two warehouses in the Guimaras terminal, with capacities of 9,000 and 16,000 tons. A third one is under construction and will hold 31,000 tons. Sugar moves from one warehouse to another by conveyors.

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THE FATE OF THE PRINCIPAL SIMPLE SUGARS OF CANE JUICE DURING MOLASSES FORMATION

I. Preliminary Tracer Studies with Carbon-14 Labelled Sugars

By W. W. BINKLEY

(New York Sugar Trade Laboratory, 37 Warren Street, New York 7, N.Y., U.S.A.)

RADIOACTIVE elements are now an integral part of modern chemistry. The usefulness of carbon-14 in structural elucidation of organic compounds and the mechanisms of their formations and reactions is already an epic in its own right. Carbohydrate chemists have been among the leaders in this renaissance[1]. The potentialities of radiochemistry in technological sugar research have been considered[2]. Pursuant to our studies of the polymeric substances in molasses[3], we have begun an investigation with certain radioactive compounds of the fate of the principal sugars of cane juice during molasses formation. We wish to present herein some of the preliminary findings of this research.

Experimental

The cane juice in this work was reconstituted from Louisiana lyophilized whole mixed raw juice.

Analysis (% lyophilized cane juice solids) : sucrose, 81·9 ; reducing sugars (as invert sugar), 5·7 ; soluble ash, 3·0 ; insoluble ash 0·5 ; soluble nitrogen, 0·304 ; coagulable nitrogen, 0·096 ; wax, 0·6 ; organic acid (excluding amino acids), 2·0 ; other organic material, 3·8 ; colour, yellowish grey.

The final molasses was a product of the Southdown sugar factory, Houma, Louisiana, U.S.A.

Analysis (% original molasses) : sucrose, 30·30 ; reducing sugars (as invert sugar), 17·99 ; solids, 71·59 ; ash, 12·62 ; pH, 6·0.

The molasses was adjusted with distilled water to approximately 12° Brix. The diluted molasses was allowed to pass under reduced pressure through a thin bed of "Celite Analytical" filter-aid (Johns-Manville Co., New York, N.Y., U.S.A.) until the filtrate was optically clear. The optical density between 440 and 900 mμ of this clarified diluted Louisiana final molasses in a 2·53 mm cell is shown in Fig. 1.

Colour Formation at 95–97°C in Limed Cane Juice

(A) *Without added Radioactive Sugars.*—Eighteen grams of lyophilized cane juice were dissolved in sufficient distilled water to produce 150 g of solution. The reconstituted cane juice was adjusted to pH 7·80–7·85 with milk of lime (1 g of lime suspended in 19 ml water). The limed juice was heated to boiling and maintained just below boiling for 2 min. One gram of "Celite No. 535" filter-aid (Johns-Manville Co., New York, N.Y., U.S.A.) was added to the hot juice and the mixture was poured on to a filter under reduced pressure. The filtrate was refiltered through

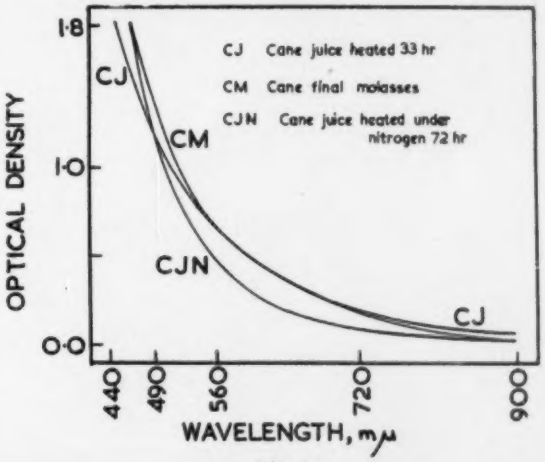

Fig. 1.

the same pad. The optically-clear limed juice was cooled to 20°C ; pH, 7·35–7·45 ; optical density, 0·07–0·08 at 490 mμ, 0·05–0·06 at 560 mμ ; Brix 12·8 to 13·0. The juice, mechanically stirred, was then heated at 95–97°C in a flask equipped with a

[1] "Symposium on Radioisotopes in Carbohydrate and Cellulose Chemistry", *Abstr. Papers Amer. Chem. Soc.*, 1958, **134**, 1D.

[2] Horning : *Z. Zuckerind.*, 1957, **82**, 216.

[3] *I.S.J.*, 1957, **59**, 64, 178 ; 1958, **60**, 62, 165, 322.

reflux condenser. Aliquots (about 10 ml each) were removed from the reaction mixture after 7, 24, 33 and 48 hr. The ranges of the pH at 20°C of the aliquots from the typical experiments were 6·1–6·3, 5·4–5·5, 5·2–5·4 and 4·9–5·2, respectively. The optical density between 440 and 900 mμ of the 33 hr sample is presented in Fig. 1.

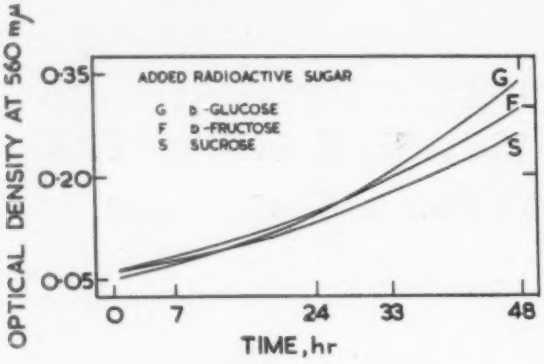

Fig. 2.

The optically-clear limed cane juice in a separate experiment was subjected to heat at 95–97°C in an atmosphere of nitrogen. The rate of colour formation was markedly slower than the reactions which were in contact with air. The optical density between 440 and 900 mμ of the 72 hr sample is included in Fig. 1.

(B) *With Radioactive Sugars Added.*—The optically-clear limed cane juice was prepared as described in Section (A). The radioactive sugars used were sucrose, D-glucose and D-fructose uniformly labelled with carbon-14 (New England Nuclear Corp., Boston, Mass., U.S.A.). An amount of one of these possessing 14 or 28 microcuries of radioactivity was added to the juice prior to the start of the heating at 95–97°C. Aliquots of the reaction mixture were removed at the previously indicated intervals. After the colour (Fig. 2) and pH of these had been determined, they were dewatered partially by freeze-drying. Final drying was achieved at 25°C under vacuum with phosphoric anhydride. The radioactivity of these products was measured by the New England Nuclear Corp.; these results are shown in Fig. 3.

Results and Discussion.

Louisiana cane juice was selected for these experiments because it was available in the form of lyophilized solids which possess good keeping qualities in a dry atmosphere. The action of heat at 95–97°C on the limed reconstituted juice produced colour bodies with optical characteristics almost identical to those of Louisiana final molasses (Fig. 1). The rate of formation and concentration of the coloured substances were expectedly lower in our studies than in the factory. Each successive syrup in sugar manufacture is richer in reducing sugars and more productive of "browning" polymers. Sucrose crystallizations were not attempted in our model experiments. Furthermore, coloration is more rapid at water concentrations less than those of cane juice[4]. The combined influence of these and other factors caused an extension of the heating period in the model experiments to approximately twice that for the industrial formation of final molasses. The polymerizations in cane juice under nitrogen appeared to differ from those occurring in normal technical processing (Fig. 1).

The principal hexoses of cane juice, D-glucose and D-fructose, undergo fragmentation when their aqueous solutions are heated at sugar factory temperatures[5]. The particular significance of these fragmentation products in the formation of molasses has been reviewed in this journal[6]. However the hydrogenolysis of cane molasses polymer gave good yields of hexitols[3]. These data indicated that certain hexoses had entered the polymer with their fundamental structures unchanged. Radioactive sugars offered the opportunity to gain some insight to the course(s) followed by these reactants. D-Glucose, D-fructose and sucrose uniformly-labelled with carbon-14 were added alone to three portions of limed cane juice and the melanoidins (molasses polymers) were allowed to form at 95–97°C. Radioassay of the lyophilized products from the reaction containing radioactive D-glucose (Fig. 3, Curve G) indicated that probably this sugar for the most part had polymerized without structural modification. The experiment containing carbon-14 D-fructose showed that this hexose underwent marked decomposition (Fig. 3, Curve F). The products would appear to be three-carbon fragments sufficiently

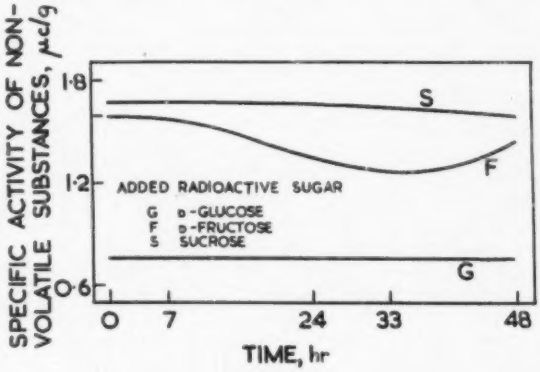

Fig. 3.

volatile to be removed (in part at least) during lyophilization. Three-carbon compounds, such as acetol and methylglyoxal, are products of heated aqueous solutions of D-fructose[5]. The concentration of these types of substances in the limed cane juice at 95–97°C reached a maximum in about 33 hours; thereafter, the rate of their polymerization neared that of their formation. These three-carbon carbonyl compounds are capable of polymerization with or

(*Continued on page* 175)

[4] Wolfrom and Rooney: *J. Amer. Chem. Soc.*, 1953, **75**, 5435.
[5] Sattler and Zerban: *Ind. Eng. Chem.*, 1949, **41**, 1401.
[6] Zerban and Sattler: *I.S.J.*, 1955, **57**, 71.

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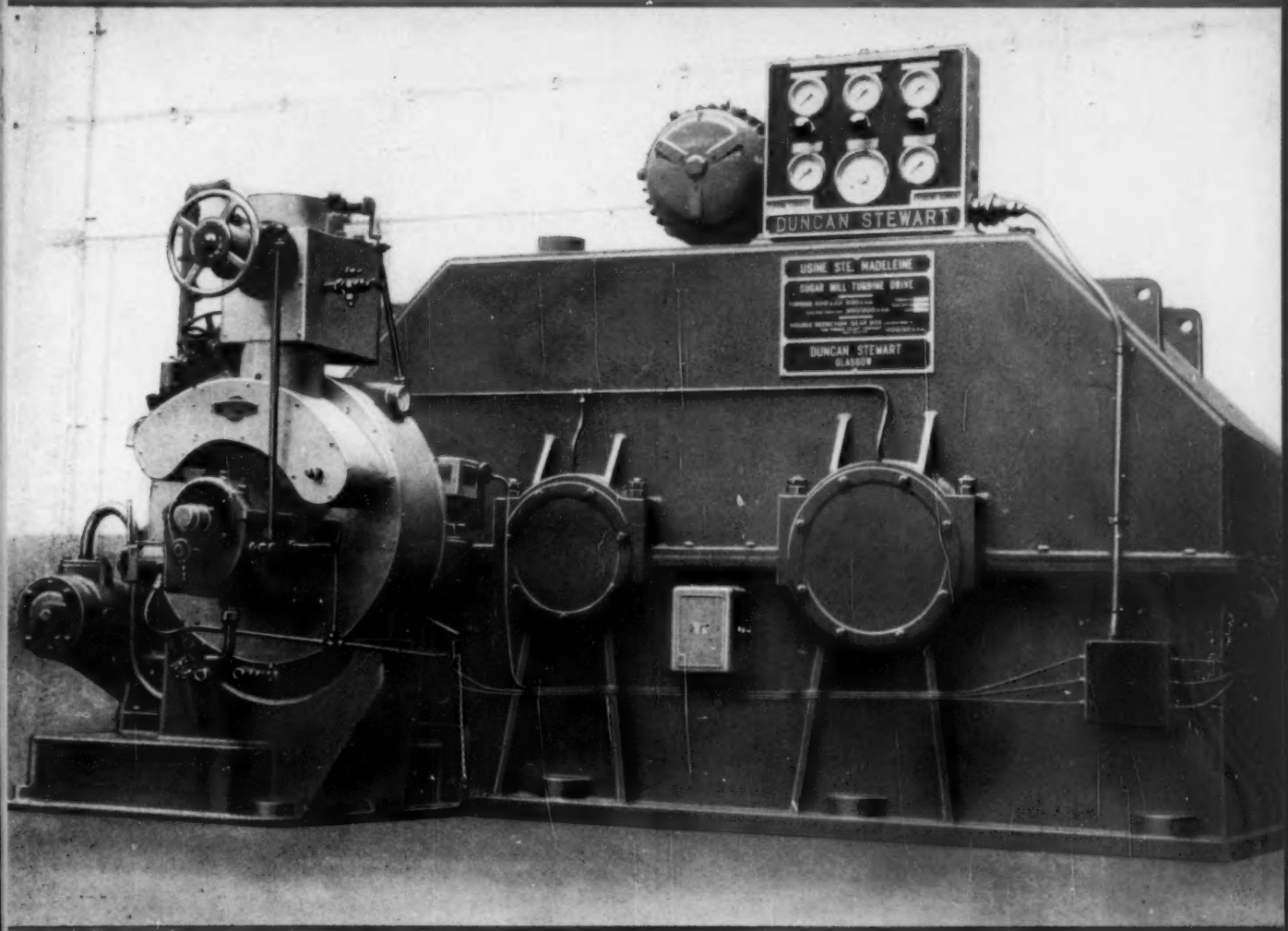

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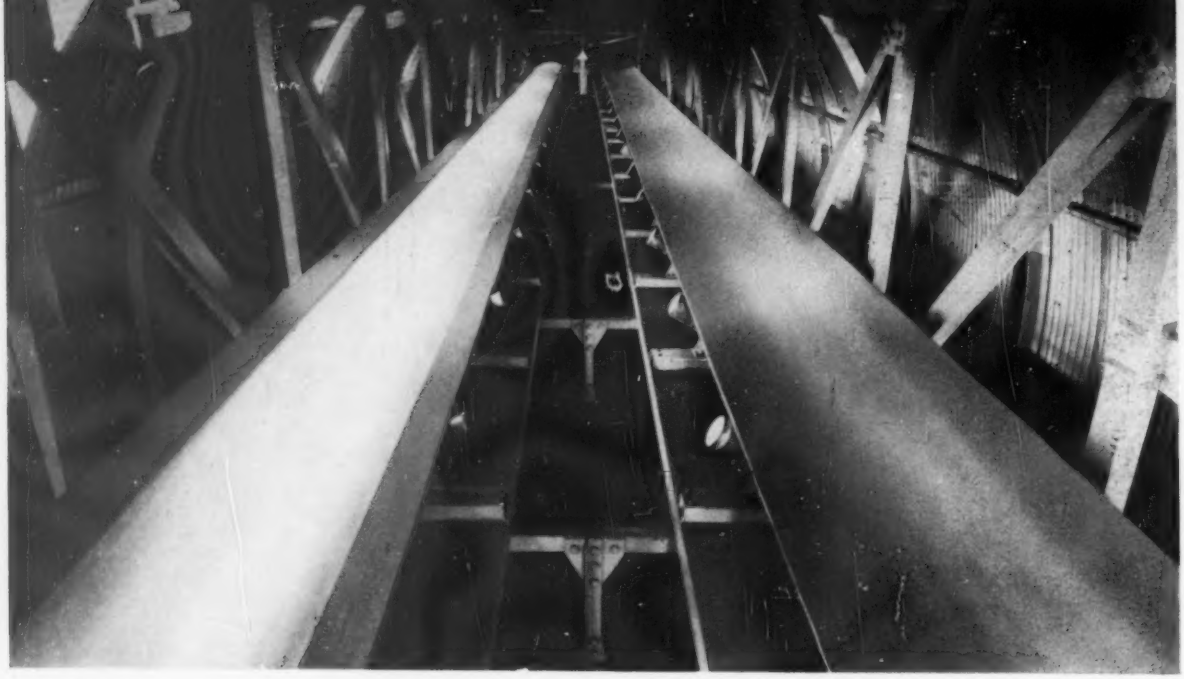

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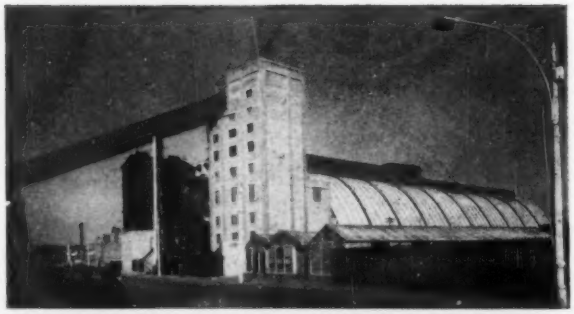
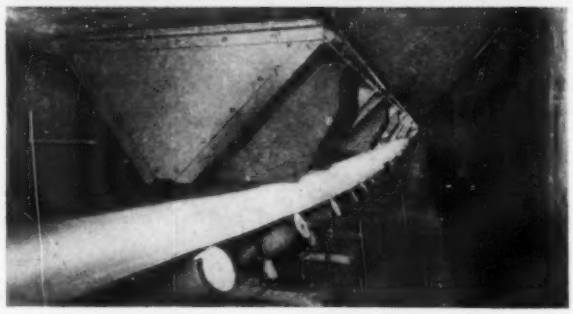
The inclined gantry above and right, is equipped with two 42 in. Spencer troughed belt conveyors. One travelling at 400 ft. per minute handles 600 tons of sugar per hour and the other at 240 ft. per minute has an hourly capacity of 350 tons. Sugar is weighed by automatic weighers in the tower before being taken by other conveyors either to the vehicle loading tower seen in the background or into the 100,000 ton silo by two Spencer shuttle conveyors operating in the roof. Sugar is reclaimed from the silo by the 42 in. wide conveyor shown bottom right, which operates beneath the silo floor where it is fed by 42 hoppers and 4 travelling feeders.





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Biological Treatment of Sugar Factory Effluents. S. N. G. RAO, J. P. SHUKLA and S. N. PANDEY. *Sharkara*, 1958, **1**, 77–87.—Methods described in the literature for treating effluents are reviewed. It was found that the primary screening and grit collection through a fixed-bar 1-inch screen and grit chamber reduced the O.A. value by 25–30%. The effluent was kept in a tank with constant aeration (to prevent stagnation and consequent putrefaction) and then passed to a high-rate biological filter. In batch runs, using a circulation ratio of 4 : 1, the O.A. load was reduced by 65–75% ; after passing the effluent through a fine sand bed, 4½ ft deep, the remaining O.A. value was reduced by 60–70%, giving a product which may be used as cooling water or run into canals or rivers.

* * *

Superior Crystalline and Liquid Sugars. H. E. WEAVER and A. G. WINGER. *Sugar y Azúcar*, 1958, **53**, (8), 27–30.—Use of ion exchange techniques has been found by a U.S. sugar producer to give improved crystalline and liquid sugar quality. The procedures followed are described and the advantages discussed.

* * *

Sugar in Panama. H. R. SHAW. *Sugar y Azúcar*, 1958, **53**, (8), 36–37.—A brief note is given on some aspects of the Panama sugar industry, with illustrations.

San Cristóbal—World's Largest Mill. E. L. SYMES. *Sugar J.* (La.), 1958, **21**, (3), 14–17. **Ingenio San Cristóbal y Anexas S.A.** ANON. *Ibid.*, 18–19, 21–22.—Cf. *I.S.J.*, 1959, **61**, 116.

* * *

Ion Exchange Treatment of Clarified Juice. R. ARRIAGA. *Sugar J.* (La.), 1958, **21**, (3), 27, 30.—A 12-day test was carried out at Ingenio Independencia in which clarified juice was passed through filters of IMAC C-12 resin, in the sodium form, whereby the Ca content was replaced by Na. The use and regeneration cycle is described. The treatment was found to reduce evaporator scaling to a soft incrustation in the lower part of the 4th effect.

* * *

Calculating Clarification Efficiency. B. N. PANDEY and A. S. BHATIA. *Sugar y Azúcar*, 1958, **53**, (9), 31, 45.—See *I.S.J.*, 1958, **60**, 299.

* * *

Correcting Boiler Failure in Pakistan. A. M. SHAIKH and M. SADIQ. *Sugar y Azúcar*, 1958, **53**, (9), 32–33.—Hasty construction of steam generation plant at Charsadda factory caused inefficient combustion and structural failures. The first was due to excess air caused by inefficient bagasse hopper doors, too large a grate area and too many secondary air-holes. The second was largely due to the weakening of roof arches by the presence of the excess air-holes, the absence of proper expansion joints, and faulty construction of the fire bridge walls and substandard brickwork. These defects required complete dismantling and replacement of the whole brickwork with expansion joints and steel bracings where necessary, and a smaller grate, two instead of four bagasse chutes, the proper number of secondary air-holes, and a redesigned bagasse hopper opening. Fuel consumption has thereby been reduced to the theoretical amount.

* * *

Starch Content in Taiwan Raw Sugar. T. G. CHIU. *Taiwan Sugar*, 1958, **5**, (6), 21–29.—Analysis by the method of BALCH[1] was used to survey the amounts of starch in parts of the cane, using a number of Taiwan varieties, and in juices, syrups, molasses and sugars. Variations in clarification technique to reduce the starch content were examined, including the use of phosphate, polyelectrolytes, fractional liming and double heating ; addition of phosphate was found to be the most effective of these. Use of NaOH to replace part of the lime was found to

[1] *Sugar J.* (La.), 1942, **5**, (8), 11–15.

Fate of the Principal Simple Sugars.

without amino acids and proteins and this situation would contribute significantly to the complexity of the molasses polymer. Sucrose exhibited expected stability (Fig. 3, Curve S). Inasmuch as the pH of the juice approached 5 near the end of the heating period, some slight hydrolysis of the sugar seems to have occurred. Fragmentation of some of these products is reflected in the gentle downward slope of the final portion of the curve.

SUMMARY

Radioassay of the non-volatile products from the heating at 95–97°C of limed cane juice admixed with uniformly-labelled carbon-14, D-glucose, D-fructose and sucrose, separately, indicated that the D-glucose had polymerized without structural change. D-fructose underwent significant fragmentation ; sucrose exhibited expected stability.

ACKNOWLEDGMENT

The writer wishes to thank Dr. L. F. MARTIN, Head Sugarcane Investigations, United States Department of Agriculture for the lyophilized cane juice and the analytical data on this material.

improve clarification, starch removal and sugar filtrability. Since 40–50% of the starch in 3rd sugars was contained in the molasses film, double purging was examined to try to reduce the amount returning to previous massecuites ; starch removal was about 20–40%. Passing raw juice through a centrifuge removed about 80% of the starch but gave a juice which settled very slowly. Turbidity was reduced, however. Addition of phosphate improved settling as did addition of 40% or more of ordinary raw juice. Addition of diastase to massecuites for hydrolysis of the starch was unsuccessful.

* * *

Improving the Exhaustibility of Final Molasses. (Clarification of Penultimate or B-Heavy Molasses). J. M. SAHA, D. L. N. RAO and V. SINGH. *Indian Sugar*, 1958, **8**, 263–267, 280, 283–288.—In the double carbonatation process described, *B*-heavy molasses is diluted to 20–21°Bx, heated to 45°C, limed with 10% v/v of 20°Bé milk of lime, gassed with CO_2 to pH 10·8 and filtered, and the filtrate gassed to pH 8·8, heated to 70°C and refiltered. The filtrate is treated with triple superphosphate solution and/or SO_2 to pH 6·7–6·8, heated and again filtered, giving a 16·5°Bx solution which is then evaporated. The equipment required is that used by a double carbonatation factory of about one-fifth the capacity of the factory producing the molasses. Laboratory trials have given good rates of filtration comparable to thin juice carbonatation; the purity rise is about 8–9 units for both carbonatation and sulphitation molasses, ash removal is appreciable and reducing sugars not so high with sulphitation molasses but quite high with carbonatation molasses. Viscosity of molasses is reduced, indicating removal of colloids, gums, pectins and waxy impurities.

* * *

Two and a Half-Massecuite System. P. DÍAZ QUINTANA. *Bol. Ofic. A.T.A.C.*, 1958, **17**, 543–547.—A description is given of the procedure whereby three boilings are made but one is of much smaller quantity than the others[1]. It is required by the fact that it is not possible to exhaust the molasses in two stages without cooling the final massecuites. A first massecuite is boiled of 85 purity, giving a first molasses of 65 purity ; part of this is built up to a 75 purity strike on a footing of final sugar as seed and produces a second molasses of 55 purity which is used, with the remainder of the first molasses, to build up the final strike which is of 62–63 purity, yielding a final molasses of 32–35 purity, depending on the reducing sugars : ash ratio.

* * *

Fly Ash Collection. R. RAFFRAY. *Rev. Agric. Sucr.* (Mauritius), 1958, **37**, 128–131.—The various types of dust collector—gravitational, inertial, filtration, spraying and electrical—are briefly reviewed. A cost analysis would be necessary to determine which of three possibles—cyclone, mechanical centrifugal separator and scrubber—is most suitable.

New System (of Mill Control) being adopted in Cuba. U. VILLAR. *Sugar y Azúcar*, 1958, **53**, (10), 44–46.—A number of Centrals have adopted the new concept of "absolute juice" as defined by the I.S.S.C.T. instead of the former "normal juice". The calculation of milling efficiency with both concepts is discussed and examples worked with detailed comparisons of the figures obtained.

* * *

Sugar in Costa Rica. H. R. SHAW. *Sugar y Azúcar*, 1958, **53**, (10), 48–49.—A brief illustrated description is given of some aspects of the Costa Rican sugar industry.

* * *

Deterioration of Sugar in Godowns—Instrument for Measuring the Moisture Content. N. A. RAMAIAH and V. S. RAMAN. *Sugar J.* (La.), 1958, **21**, (5), 20–21.—See *I.S.J.*, 1958, **60**, 298.

* * *

Deterioration of Raw Sugars in Storage. W. L. OWEN. *Sugar J.* (La.), 1958, **21**, (5), 22–25.—The introduction and development of bulk storage has given rise to problems of microbiological deterioration which is easier with storage in bulk than in bags. It is suggested that sugar standards, e.g. "factor of safety" should be re-appraised in this connexion. "Spontaneous combustion" of refined sugar in two cases is attributed to spontaneous ignition of the twine used to sew up the sacks and not of the sugar. The increasing tendency for deterioration of molasses is noted, and it is suggested that molasses should be tested for stability before storage in tanks or tankers. An increase in apparent purity of raw sugars sometimes occurs as the result of preferential destruction of fructose by osmophilic and other yeasts.

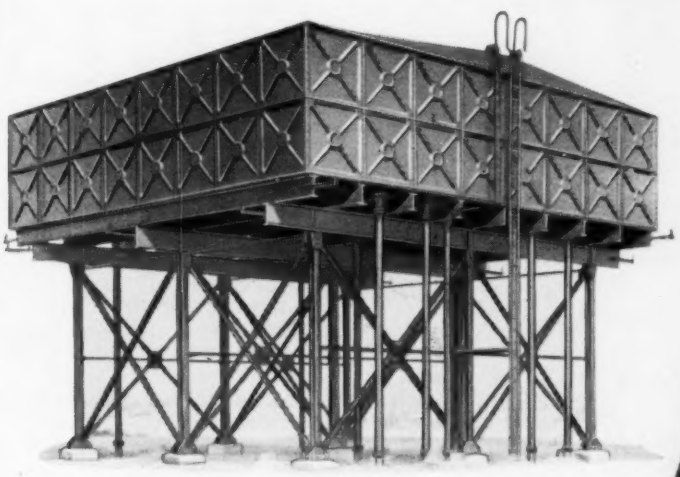
* * *

Methods used in Thailand Sugar Factories. J. C. P. CHEN. *Sugar J.* (La.), 1958, **21**, (5), 30–32.—The development of the Taiwan sugar industry is surveyed.

* * *

Recent Improvements in the Quality of SWC (Superior White Crystal Sugar). Y. C. CHIU. *Taiwan Sugar*, 1958, **5**, (7), 13–17.—Ash content of SWC sugar produced in the 1957/58 crop was 0·037–0·041% and colour and sediment test results were comparable with those of refined sugar. This was achieved by a number of steps, including : continuous preliming of mixed juice at 55°C to pH 10·5, and batch first carbonatation during 7–8 minutes instead of 4–5 minutes as previously (these resulted in better filtration); continuous second carbonatation with mixing by use of a recirculation pump; and replacement of old presses with new leaf filters, including Sparkler RSC units for part of the 2nd carbonatation filtration and for syrup filtration. The boiling scheme was modified so that double-purged 3rd sugar was remelted and added to the syrup before sulphitation and filtration, while shock seeding of first molasses gave an intermediate

[1] Cf. ALEMÁN: *I.S.J.*, 1959, **61**, 86.



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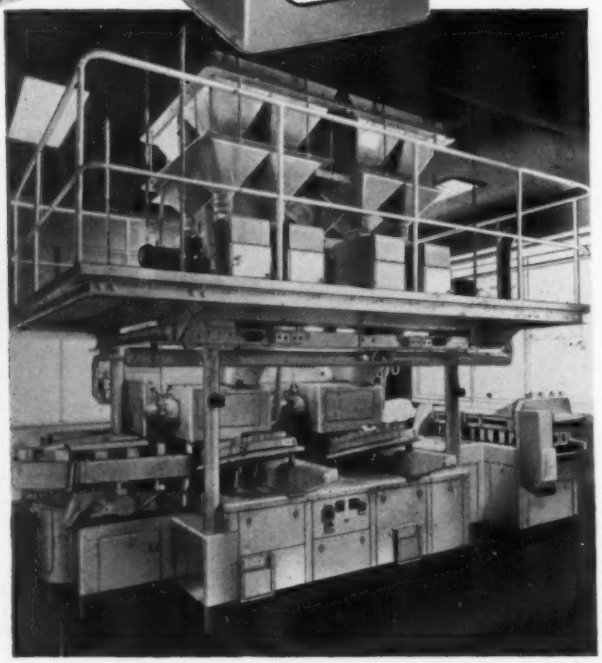

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massecuite which was purged and the "small seed" crystals so obtained mingled with first molasses to act as a footing for the true second sugar, this being used as seed for the first massecuite. Exhaust steam was used for pan cleaning instead of live steam, and rust, dirt, etc., was minimized by using: galvanized syrup collecting gutters in the presses; painted cast iron syrup receiving tanks; new or thoroughly cleaned syrup pipelines; copper or copper-lined sugar wash water system; copper discharge hoppers under the first product centrifugals; galvanized-lined grasshopper conveyors for first sugar ; tightly wooden-covered tanks, gutters and mixers for syrup and molasses ; improved sanitation near the supply tanks in the pan house ; tightly-covered steam pipe lines to prevent insulation material getting in massecuites and sugars; covered transmission belts; and complete closure of the seed room to prevent seed sugar contamination; the intermediate 1st massecuite receiving crystallizer was eliminated to avoid dead angles and contamination. A formal statistical quality control programme has been started.

* * *

Recent Advances in Sugar Technology in India. S. N. G. RAO. *Indian Sugar*, 1958, **8,** 321–323.—Original Indian research carried out during 1957 in certain fields of sugar technology is surveyed, with 24 references to the literature.

* * *

Some of the Factors Affecting the Behaviour of Starch as a Flocculant in Cane Sugar Juice. M. C. BENNETT. *Chem & Ind.*, 1958, 1552–1553.—The activity of starch in increasing the sedimentation rate in a flocculated cane juice is related to the bound-phosphate content (total minus admixed inorganic phosphate); it is very sensitive to small concentrations of electrolytes in the starch solution (these are thought to bring about a compression of the double-layer around the charged centres so diminishing their effects and contracting the flexible amylopectin structure); the activity may also be greatly changed by varying the concentration of the starch solution while adjusting the volume to maintain constant starch addition at 50 p.p.m. Retrogradation of the starch lowers its activity.

* * *

The Straight Two-Boiling System. R. NOEL. *Sugar J.* (La.), 1958, **21,** (3), 32–33.—See *I.S.J.*, 1959, **61,** 19.

* * *

Have we a Yardstick of Mill Efficiency? H. W. KERR. *Australian Sugar J.*, 1958, **50,** 405, 407–408.—The apparent decrease in efficiency of mills, as measured by the "coefficient of work", is attributed to: the unreliability of the "3" and "5" factors in the c.c.s. formula as far as modern hybrid canes are concerned; the increasing amount of soil brought in with the cane and not allowed for ; and the presence of dry trash and green tops. Thus, it is argued for factory control purposes, the basis should be weighing and analysis of juice and analysis of bagasse.

Use of Cinders instead of Hard Coke in Lime Kilns. S. C. GUPTA. *Sharkara*, 1958, **1,** 158.—Cinders from coal-fired paper mills were sun-dried, screened to remove ash and dust, and hand-picked to remove fused lumps. It was then used as a replacement for part and later all of the hard coke used in the lime kiln. It proved adequate provided that the gas scrubber was cleaned frequently enough to prevent carryover of dust, and the milk of lime sieves were changed to a finer mesh, to overcome choking of the valves in the milk of lime pipeline.

* * *

Spontaneous Combustion of Molasses. D. S. PATIL. *Proc. 15th Conv. Deccan Sugar Tech. Assoc. (India)*, 1958, 31–36.—An account is given of the spontaneous decomposition of molasses in storage which occurred at Kopargaon during the 1957/58 season. The froth layer broke and vigorous boiling followed. The mass solidified after 3–4 months, with a porous structure, smelling of acetic acid. The causes are chemical rather than microbiological, and various opinions on causes are quoted from the literature. The author concludes that the manufacturing process was not a direct cause; that overheating of molasses should be avoided ; and that the storage tanks should have a proper floor, walls and cover.

* * *

Abnormal Juices in Ugar Sugar Works Ltd. During the Season 1957/58. Y. K. ATHAVALE, J. V. MANTRI and R. K. KULKARNI. *Proc. 15th Conv. Deccan Sugar Tech. Assoc. (India)*, 1958, 39–41.—In a period of drought the apparent purities of juices were unusually high—about 86—but recovery was low and molasses production high. Similar effects are recorded in the literature and attributed to formation of unknown optically-active substances, as a result of drought, which artificially increase the apparent purity.

* * *

Boiler Efficiency Calculations and Steam Available in a 1000-tons Sugar Factory. R. D. JOSHI and M. K. VAIDYA. *Proc. 15th Conv. Deccan Sugar Tech. Assoc. (India)*, 1958, 51–61.—Using the method described by TROMP[1], boiler efficiencies are calculated and tabulated for factories using 123–200% of theoretical air required, producing 23–29% bagasse on cane, of 42–48% moisture content, but assuming complete combustion to CO_2 and water.

* * *

Steam Consumption. C. G. M. PERK. *S. African Sugar J.*, 1958, **42,** 845–855.—Calculations are presented for determination of steam consumption in evaporating and boiling sugar juices and in power consumption, based on the Brix; this is considered a more reasonable basis than the weight of cane since the composition of the latter varies so much, affecting the steam consumption considerably. The calculations allow for different juice and syrup Brixes, and vapour bleeding.

[1] *Proc. 19th Conv. Sugar Tech. Assoc. India*, 1950.

Purification of Diffusion and Press Waters Returned to Diffusion. E. T. KOVAL', A. YA. ZAGORUL'KO and A. A. LIPET. *Sakhar. Prom.*, 1958, (8), 24–29.—The advantages and disadvantages of four different methods of waste water treatment for re-utilization are discussed and compared with return of untreated water. Tests carried out in 3 Soviet factories showed : that pulp pressing should be rapid and the presses and water purification plant should be located as near as possible to the diffuser ; that rotary pulp catchers are the most effective means of pulp removal, guaranteeing a minimum period of water retention ; and that the best method of removing suspended material from the water is to settle for 20 minutes after heating to 80–85°C at pH 6–6·5. This ensures sterilization and prevents an increase in the amount of reducing substances without a drop in pH. Graphs are given of results and of the kinetics of sedimentation. It is pointed out that the suspensions in press water are removed with the pulp but pass into the diffusion juice of rotary and tower diffusers.

* * *

Experience in Processing Raw Cane Sugar. E. I. OBUSHINSKII. *Sakhar.Prom.*,1958, (8), 39–41.—A number of factories have been processing raw cane sugar with beet (See *I.S.J.*, 1959, **61**, 148) and a number of schemes are described. The best point at which to introduce the cane raws is considered to be the 2nd product crystallizer in a 2-product system or the 3rd product crystallizer in a 3-product system, adding 15–20% by weight of massecuite. Before adding the raws, or simultaneously, final molasses (150% by weight of raws) should be added. The temperature of the molasses should be 4–5° higher than that of the massecuite, and the maximum crystal content of the product should be 42%. The need to ensure that the massecuite is alkaline is stressed. In another scheme the raw sugar is melted with yellow sugar and the melt processed as normally, the disadvantages lying in the non-removal of the non-sugars adhering to the raws which pass into process. At two factories the melt is returned to defecation ; this makes purification easier but increases the quantity and Brix of the juice, so making filtration more difficult. A molasses loss of 7–8% on raws resulted when working beet and cane raws simultaneously.

* * *

Improving Vacuum Filtration Equipment. S. D. GRINMAN. *Sakhar. Prom.*, 1958, (8), 42–43.—The snags encountered when replacing filter-presses with vacuum filters (greater weight, floor space requirements and cost) are discussed and a new design of deep-immersion cell-type rotary vacuum filter described and illustrated diagrammatically. It is claimed that the design will use far less electrical power than a vacuum filter of the usual immersion, and will have greater efficiency. The need to construct and test the design as soon as possible is stressed.

* * *

Optimal Design of Hydraulic Colums. M. L. VAISMAN. *Sakhar. Prom.*, 1958, (8), 46–50.—The opinion of A. E. KUTSENKO[1] that the Niessner condensate removal column is more efficient than the Central Research Institute hydraulic column is not shared, the larger dimensions of the former being considered disadvantageous and not ensuring complete flash-evaporation and good steam separation as claimed. Formulae are given for the calculation of steam pressure in the evaporator (on which depends flash evaporation) and of the effective column height at a given difference between the pressures in the steam chests of adjacent effects. From these it is shown that the large dimensions would result in low resistance. Reversed flow and consequent break-through have been found with the Niessner column. Advantages of the Central Institute's column are discussed.

* * *

Boiling out Juice Purification Equipment. V. N. TRET'YAKOV. *Sakhar. Prom.*, 1958, (8), 60–61.—Boiling out defecators, saturators, juice heaters and filters with a 5% solution of Na_2CO_3 has been found effective in softening scale which is then easily washed off. The soda is dissolved in condenser water and heated to 90–95°C. The operation takes 30 hours and the temperature in the heaters is maintained at 100°C. The cloths are not removed from the filter presses.

* * *

Heat Calculations for a Second Product Vacuum Pan (in a Two-boiling System). V. T. GARYAZHA. *Trudy Kiev Tekhnol. Inst. Pishchevoi Prom.*, 1957, **17**, 81–90; through *S.I.A.*, 1958, **20**, Abs. 642.—Calculations by Popov's method are made from results obtained on boiling green syrup of 78° Brix, 77–78 purity in standardized conditions. Values for syrup Brix and purity, supersaturation coefficient and temperature are presented in graphs. The readings were taken at regular intervals throughout the boiling. Quantities of massecuite, water evaporated, dry substance and heat transfer coefficient are calculated, the latter by the author's equation. The heating surface F is calculated as :

$F\tau_{ts} = \int_0^Q \frac{dQ}{K \Delta t}$ sq.m./hr, where τ_{ts} = actual boiling time, Q = heat consumed in kcal, Δt = temperature

[1] *I.S.J.*, 1958, **60**, 367.

difference in °C and K = heat transfer coefficient. For 3% heat loss, $F = 1{\cdot}80$ sq.m./1000 kg of syrup. With the Glavsakhar norm of $K = 1{\cdot}4$, F would be 4·08 sq.m. In factory practice, owing to rapid concentration to supersaturation in the first period, and high massecuite level in the final period, the value of K does correspond to the norm. For regular operation, the rate of regular syrup intake can be calculated, as also the dry solids intake and water evaporated.

* * *

Increasing Sugar Yield by Using Ion Exchange Resins. W. WISFELD. *Zucker*, 1958, **11**, 425–436.—Ion exchange resins, ion exclusion and the use of permeable membranes are reviewed, with a mention of the reverse-bed technique for the prevention of inversion. The SCC process first used at Leopoldsdorf factory in 1957 is described : alkali ions in 80% of the thin juice are replaced with ammonium ions, using a "Lewatit S 100" resin, and the treated juice, with the untreated 20%, is then limed. Excess lime is removed by carbonatation and filtration while the free ammonia is removed during evaporation. The resin is regenerated with ammonium sulphate. Seventy per cent of the alkali ions are exchanged for Ca, and amino compounds also fixed to a certain extent, particularly when the resin is freshly regenerated. Formation of calcium carbamate is prevented by maintaining a juice temperature higher than 90°C during carbonatation, and no scale forms in the evaporators, owing to the low solubility of $CaCO_3$, to the high pH (that of the thick juice is about 8) and to the high Ca ion concentration. The thick juice concentration at the end of the campaign was higher than 60°Bx, first product massecuite was of 95·2 purity, and after product was of 70–73 purity. A 7% increase in white sugar yield was effected. Economics of the process are discussed.

* * *

Polyelectrolytes as Flocculating Agents in the Sugar Industry. G. PILLER. *Zeitsch. Zuckerind.*, 1958, **83**, 439–441.—The effects of three polyanionic electrolytes on sedimentation rates were tested, the results being indicated in graph form. Addition of 20 mg/litre (the optimum) of "Praestol 2400" resulted in a 90% increase in sedimentation rate and an 8% increase increase in mud volume. A definite increase in sedimentation rate is obtained even if the temperature is lowered from 90° to 50°C. The increase in mud volume on adding 4 mg of "Lytron X-886" (dry solids) per litre was greater than with "Praestol", through "Lytron" had an adverse effect on the filtration coefficient which increased, over 7 determinations, from 2 to 3·4. The settling rate on adding "Rohagit 7463" at the rate of 3–4 mg/litre was increased by 94% and the filtration coefficient improved by 20%. The mud volume increased by 22%. When "Rohagit" was added to the muddy juices from deteriorated beet, the settling rate increased by 61% and 55% and the mud volume by 45% and 27%. Maintaining a juice temperature of 80°C in the decanters instead of the usual 90–95°C resulted in less invert destruction and so less colour formation, giving a bright clear juice. Two polycationic acetates were also tested. Results showed that 0·15% polycation must be added to raw juice to precipitate a maximum amount of colloids ; that the optimal temperature for precipitation is 75–80°C ; and that the treated juice is bright green with a reddish lustre and can be kept for a week without any alteration in pH or colour, the polycation acting as a disinfectant. After addition of 0·6% CaO on beet to this juice in the laboratory, the juice was carbonatated to optimal alkalinity without deterioration in the colour.

* * *

Low Temperature Beet Diffusion. II. P. W. VAN DER POEL, J. B. LE POOLE, B. J. SPIT and H. I. WATERMAN. *Sugar y Azúcar*, 1958, **53**, (9), 26–27, 45.—Electron microscopy of beet tissue subjected to the same conditions as normal diffusion and to those obtaining in the low temperature method[1], indicates that pectic substances are removed during the former but not during the latter.

* * *

Decolorizing Ion Exchangers. IV. Laboratory Tests on Capacity Changes with Recycling. Z. MENCL, V. VALTER and A. DUSBABOVÁ. *Listy Cukr.*, 1958, **74**, 193–196.—Changes in the adsorption capacity of "Wofatit E", "1A" and "5A" ion exchange resins were studied in laboratory tests by treatment of molasses solution. Up to 5 cycles, capacity decreases with the number of cycles, "5A" being the most stable and "1A" showing the greatest change, with a capacity drop of more than 50%. The methods adopted in the tests are described in detail; and it is pointed out that the initial capacity is no real guide to the efficiency of the resin, at least 5 cycles being required.

* * *

Methods of Reducing Molasses Yield. V. SÁZAVSKY. *Listy Cukr.*, 1958, **74**, 197–205.—The relationship between sugar in beet, thick juice and molasses purities, and molasses production is discussed and calculations tabulated as examples. The most reliable guide to molasses yield is considered to be the relation between thick juice conductimetric ash and molasses ash, and tables are given for molasses production at various values of thick juice ash and of r (reciprocal of molasses ash); this method gives results within ±0·05%. The importance of good beet and juice processing to give high purity thick juice is stressed. The effect of good low-grade processing is also important, and the amount of water to be added to massecuites is discussed on the basis of GRUT's number (non-sugar in massecuite : water in massecuite). The Sandera factor for calculation of water addition, based on the massecuite ash content, is also discussed and coversion tables are given. The calculations are based on a viscosity of 4000 cp for the syrup to be centrifuged, which is again based on practice in the Soviet Union. The relationship between

[1] *I.S.J.*, 1959, **61**, 55.

the original Sandera empirical factor and the GRUT number is also calculated. The effect of the relative molarity of the non-sugars in solution on the sugar solubility or the saturation coefficient is studied and found to be only an approximate guide. Cooling of the low-grade massecuite with air is consideredmore advantageous than with water. Recirculation of remelted low-grade sugar to carbonatation is recommended, since part of the non-sugars will be removed, and the sugar yield increased, with lower molasses production.

* * *

A Study of (Beet) Flume Profiles. J. HRUBÍSEK. *Listy Cukr.*, 1958, **74**, 207–212.—Comparative calculations have been made of beet flow along flumes of various cross-sections using the method of G. M. Znamenskii. Twenty-two different types of flume were considered, including 8 different profile shapes, all calculations (for widths of 30, 40 and 50 cm) being based on a rectangle of width "a", height "2a", a depth of beet/water mixture of "1½a" and a gradient of 1 : 100. The flow of beet/water mixture (v), is expressed by an equation

$$v = 0{\cdot}05863\ C\sqrt{a}$$

where a is the width, and C a factor given by $\frac{6m(m-1{\cdot}1)}{m+1{\cdot}1}$ where m = weight of water on beet.

The amount of beet flumed (q) is given by :

$$q = \frac{64{\cdot}5\ C\ a^2\sqrt{a}}{9{\cdot}458 - 15{\cdot}314a + 13{\cdot}072a^2}$$

The maximum beet flow rate is effected in a rectangular flume with the bottom corners rounded at a radius of $0{\cdot}1a$. In this, clay will settle to a height of $0{\cdot}4a$. Such a flume 30 cm wide will deliver 1·44 times as many beets as a flume with semi-elliptical profile, and 1·97 times as many as one with a semi-circular base. At this width the amount of water should be 481% on beet, and the rate of flow of beet and water 0·613 m/sec. Data are tabulated for the optimal flume profile at depths of 0·5 to $2{\cdot}0a$ in tenths, a being 30, 40 and 50 cm.

* * *

Economic Effect of Campaign Length. G. OPLATKA. *Sborník Cukrovarnicko-Reparske* 1955 *Konf. v Praze*, 1957, (2), 581–601.—The optimal campaign length and the effect of various factors on sugar outturn and production costs are discussed on a mathematical basis, with an example calculation for a given set of circumstances.

* * *

Tare Laboratories—Aids to Sugar Beet Research. B. PERETJATKOWICZ and Z. SRZEDNICKI. *Sborník Cukrovarnicko-Reparske* 1955 *Konf. v Praze*, 1957, (2), 629–636.—The first tare laboratories in Polish factories were established in 1953 and numbered 17 by 1955. Besides determining the sugar content of beets, they are carrying out work on the causes of losses during storage, analysis of beet seed and fertilizers, determination of soil acidity, meteorogical observations, etc.

Treatment of Ammoniacal Waters to be used for Diffusion Feed Water. P. DEVILLERS. *Sucr. Franç.*, 1958, **99**, 251.—Ammoniacal water may be satisfactorily treated at low cost with a carboxylic acid-type cation exchanger such as "Amberlite IRC 50", which will adsorb bases but does not split salts. The resin has a capacity of 700 volumes of water of 0·14 alkalinity (as g CaO/litre) and gives an effluent of pH 5–7.

* * *

Organization and Technique of Sugar Beet Storage in the U.S.S.R. A. N. SHAKIN. *Sborník Cukrovarnicko-Reparske* 1955 *Konf. v Praze*, 1957, (2) 602–616.—Longer beet campaigns have necessitated a thorough investigation of storage problems, including changes in beet composition during storage. A set of compulsory instructions regarding beet storage and quality control have been drawn up on the basis of studies made at the Central Research Institute. Freezing of the beets has given satisfactory results, but no positive results have been obtained in the prevention of sprouting and various biochemical processes in the beet by treatment with organic chemicals. Radioactive tracers have been used in studies on beet composition and preservation.

* * *

Tests on Beet Storage in Poland. B. PERETJATKOWICZ and A. KARATNICKI. *Sborník Cukrovarnicko-Reparske* 1955 *Konf. v Praze*, 1957, (2), 617–628.—Numerous tests have been made during the past 10 years in Poland, storing beets in clamps and prisms or piles. Typical losses for beet stored 27 days were 0·18% in clamps and 0·11% in piles. The inconsistency of the climate from year to year has been an obstacle to drawing definite conclusions from experiments with various types of protection, e.g. earth, mats, lime, ventilation, but it has been shown that good results can be expected from spraying the piles with 5°Bé milk of lime.

* * *

Factors Affecting the Temperature of Stored Beet. S. VAJNA. *Sborník Cukrovarnicko-Reparske* 1955 *Konf. v Praze*, 1957, (2), 637–660.—Factors affecting the temperature of beet stored in piles are discussed with particular reference to respiration and ventilation. The average temperature of the pile can be calculated from the mean values of the inside and ambient temperatures throughout the storage period. The effect of wind is significant, but must obviously be left out of calculations. The shape of the pile, type of ventilation and covering affect the calculations of air velocities, so that the validity of the calculations was checked by using low, very wide piles which obviated the use of forced ventilation and where differences between the surface and inside temperatures were small and sugar losses low.

* * *

Problems of Mechanical Beet Storage and of the Control of Losses. A. VODICA. *Sborník Cukrovarnicko-Reparske* 1955 *Konf. v Praze*, 1957, (2), 661–672. Good storage requires the use of ample pure cold wash

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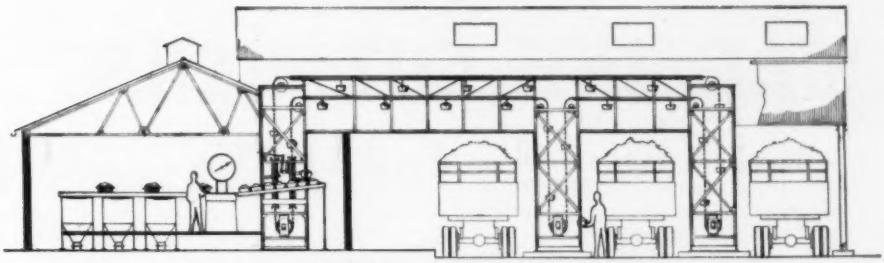

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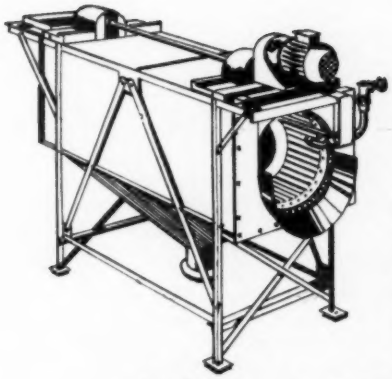

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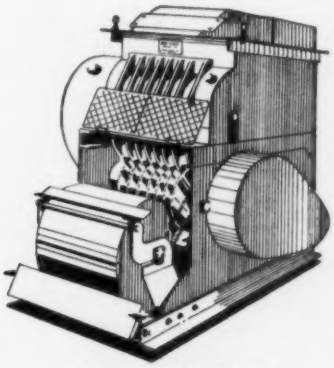

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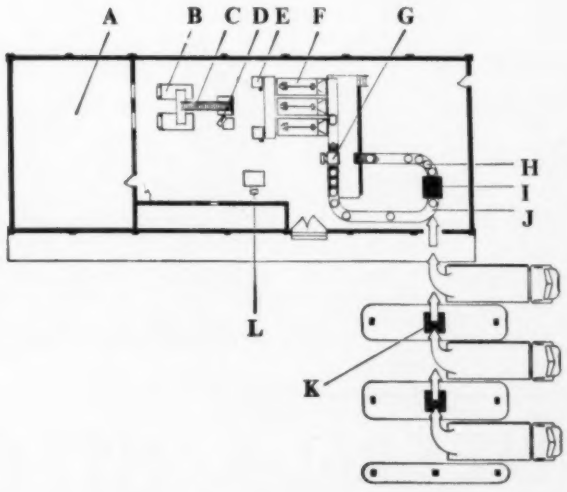

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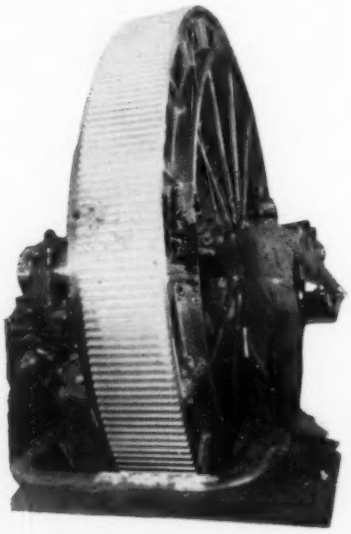

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water and good separation of leaves, dirt and beet tails and broken pieces. Losses for average beets in 1953/4 were 28 mg % daily, for wilted beets 48 mg % and for damaged beets 83%. In 1954/5, with control of the beets in separated groups, the daily losses were for three qualities of beets, 11 mg %, 31 mg %, and 60 mg %. The first two groups (average 19 mg %) represented 75·6% of all beets sampled.

* * *

Purification of Beet Juice and Utilization of Waste Products. I. Purification of Beet Juice. J. VASÁTKO and R. KOHN. **II. Fermentation Production of Lactic Acid using Calcium Saccharate obtained in Sugar Recovery from Molasses[1].** J. VASÁTKO and M. GÄRTNER. **III. V. K. Chalk[2].** J. VASÁTKO, V. KRIZAN and A. LUKACOVIC. *Sbornik Cukrovarnicko-Reparske* 1955 *Konf. v Praze*, 1957, (2), 673–687.—(I) The electrokinetic potential of 1–10μ particles of $CaCO_3$ in solutions of $Ca(OH)_2$ and $Ca(HCO_3)_2$ was determined using electro-osmotic and electrophoretic methods[3]. Fine particles had a potential of +32 mV and coarse particles a potential of +27 mV in $Ca(OH)_2$, while the maximum potential in $Ca(HCO_3)_2$ solution was +22·5 mV. When formed during saturation, the $CaCO_3$ particles had a potential of +17 mV to +20 mV, depending on the degree of saturation. $Ca(OH)_2$ particles in lime-water had a potential of +13 mV to + 15 mV. Studies were also made of the electrokinetic potential of carbonatation mud particles[4], and the question of liberating the Ca attached to carboxylic group of pectic acid also investigated. If sufficient natural alkalinity (as NaOH or KOH) is present during defecation, double decomposition occurs with formation of an ionized alkali metal pectate. On over-saturation, the charge on the pectic acid is neutralized, and macromolecule formation can occur. Thus the return of over-saturated first carbonatation juice to pre-defecation is recommended in order that large aggregates will be formed, resulting in improved sedimentation of the muds and filtration of the juice.

* * *

Effect of V-K Chalk on the Chemico-Technicological Value of Sugar Beet During Storage and Growth. D. IVANCENKO. *Sbornik Cukrovarnicko-Reparske* 1955 *Konf. v Praze*, 1957, (2), 688–694.—The effect of V-K chalk on stored and growing beet was tested. In a 20-ton beet pile, treated with 0·3–0·4% of V-K chalk on beet the daily sugar losses were 0·029%, 0·020% and 0·010% after 32, 34 and 40 days storage compared with losses of 0·205%, 0·050% and 0·033% in untreated piles. In addition, non-sugars, colour, reducing substances and lime salts in juices were reduced and the purity and filtration rate of first carbonatation juice were increased. Spraying growing beet with 60 kg V-K chalk per hectare improved resistance to virus diseases and increased sugar content by 0·4%.

* * *

Technological Evaluation of Sugar Beet. P. M. SILIN. *Sbornik Cukrovarnicko-Reparske* 1955 *Konf. v Praze*, 1957, (2), 704–710. Sugar production c is calculated from the % sugar content of the beet p, the % of non-sugars from the beet which pass through to the molasses, n, and the melassigenic coefficient m, by the equation: $c = (p - 0{\cdot}9 - n.m)$% beet. The coefficient $m = q_m/(100 - q_m)$, where q_m is the molasses purity. The value of n depends on the juice purity q_s, after defecation, and the final equation is :

$$c = p - 0{\cdot}9 - \frac{(p - 0{\cdot}9)(100 - q_s)}{q_s} \cdot \frac{q_m}{100 - q_m}$$

* * *

Payment for Sugar Beets According to Sugar Content. W. WÖHLERT. *Sbornik Cukrovarnicko-Reparske* 1955 *Konf. v Praze*, 1957, (2), 711–723.—The question of payment for beet on a basis of sugar content is discussed. Tests have shown that polarization is the only sure method of determining sugar content, refractometry, although easier and quicker, giving only approximate results.

* * *

Technological Quality of Beet. M. DRACHOVSKÁ and K. SANDERA. *Sbornik Cukrovarnicko-Reparske* 1955 *Konf. v Praze*, 1957, (2), 724–754.—Studies have been made on suitable guides to the technological quality of beets and for estimating white sugar and molasses yields. Selective adsorption of potassium permanganate and luminescence tests were used to detect damaged beets, enzyme activity and catalase accumulation being measured by the Warburg method and with H_2O_2 in glycerine, respectively. Other factors investigated were beet respiration, sugar losses in virus-affected beet and disease-resistance of different types of beet. The MW factor (molasses yield % white sugar) was calculated from statistical or analytical data and had a value of 12–22 for the best beet, rising to 25–40 for unripe, damaged or frozen beet, etc., with values of 80 or more in extreme cases. The effect of time of harvesting on the MW factor is noted, and the relationship between ash and molasses production discussed. Respiration losses of stored beet may be up to 0·45% for good beet and losses on washing may be 0·058% giving a total of 0·508%; a corresponding figure for poor beet is 1·4%. Electrical conductivity of juices obtained by extraction of cossettes at 20°C and 80°C are tabulated, the figures being higher for hot extraction.

* * *

Economic Evaluation of Filtration with Mud Presses and Rotary Filters. B. HOJDEM. *Sbornik Cukrovarnicko-Reparske* 1955 *Konf. v Praze*, 1957, (2), 775–782.—The economics of filtration of clarifier muds in presses and rotary filters are compared; although opinions differ as to juice quality obtainable, the choice would be the rotary filter from the economic viewpoint, even in the event of a slight drop in juice purity. The urgent need for parallel tests with both types of filter is emphasized.

[1] *I.S.J.*, 1958, **60**, 305.
[2] *I.S.J.*, 1959, **61**, 59.
[3] See also *I.S.J.*, 1958, **60**, 78.
[4] See *I.S.J.*, 1958, **60**, 176.

LABORATORY METHODS AND CHEMICAL REPORTS

Some Observations on Comparative Performances of Small and Large Char Filters. E. P. BARRETT, G. C. CONRAD and L. PIASECKY. *Paper presented to the 17th Ann. Meeting, Sugar Industry Technicans Inc.*, 1958.—THOMPSON, RAYNER, HILL and DE WHALLEY have stated the conditions under which they believe a laboratory filter will deliver the same volume of liquor per unit volume of char to the same final colour as a full-scale filter. PENNINGTON has compared the performance of laboratory scale filters with full-scale filters and obtained results indicating that the former yield liquors containing about twice as much colorant at the same relative volume as do the latter. This paper describes a comparison of char performance in laboratory filters and in pilot-scale filters six inches in diameter, containing a char bed 17 feet deep. Qualitatively, the results agree with those of PENNINGTON. They indicate that colours of liquors off laboratory filters are higher, at equal relative volumes of effluent, than those of the pilot filters by factors ranging from 2·25 to 5·0 depending on the relative volumes through, the nature of the adsorbent, the sugar used for testing and the technique employed by the laboratory.

* * *

Abrasion Hardness Tests for Solid Adsorbents. F. G. CARPENTER. *Paper presented to the 17th Ann. Meeting, Sugar Industry Technicians Inc.*, 1958.—Since the various test methods for hardness of bone char currently in use give conflicting results, a programme was undertaken to study the entire subject of hardness tests and to recommend a suitable test. A new test was developed which is based on a stirring action. The optimum test conditions were evaluated experimentally. A diagrammatic sketch of the equipment is given. The results are expressed in terms of the percentage reduction in particle size and percentage dust formation. The influence of particle size has been evaluated so that the chars of different average particle sizes can be compared. The new abrasion hardness test was compared with the abrasion observed in a sugar refinery. In the refinery the inherent inaccuracies of measuring the amount of char in process, combined with the very low rate of char abrasion, makes quite impossible a measure of char abrasion using data taken over short periods of operation. Averages are necessary over long periods of time, even extending into years. In this way one can obtain good values of char abrasion, which correlate well with the laboratory tests on abrasion hardness. The test results are shown to be equivalent to about 14 cycles of char house operation with respect to dust formation and to about 35 cycles of char house operation with respect to size reduction. This difference exists because the abrasion hardness test does not exactly duplicate the abrading action of the char house. Possible mechanisms of char abrasions are considered.

Determining of Phosphates in the Sugar Refinery. J. CINCOTTA and R. MOROZ. *Paper presented to the 17th Ann. Meeting, Sugar Industry Technicans Inc.*, 1958.—With a new photometric method designed to determine inorganic and organic phosphates quantitatively, a chemical balance of phosphates in the manufacture of white sugar and syrups is presented. The photometric method is based on the yellow colour that forms when an excess of ammonium molybdate solution is added to an acidified solution mixture of ammonium vanadate and orthophosphate. Strong acid digestion with concentrated nitric and sulphuric acids with subsequent hydrolysis of the organic phosphates gives reasonable total phosphate results. Observations are made on the following items : (i) Inorganic and organic phosphate, calcium and magnesium content during the purification process ; (ii) phosphate control of sweet waters ; (iii) phosphate content of the remelt system ; and (iv) general occurrence and removal of organic phosphates.

* * *

The Influence of Anions of Salts on the Solubility of Sucrose. E. MOEBES. *Zeitsch. Zuckerind.*, 1958, **83**, 383–389.—In a study of the influence of anions of various salts on the saturation concentration of sucrose it was found that the formation of addition compounds, which increase the sucrose solubility, is a molecular and not an ionic reaction. The solubility increase is greatest in the region of the maximum solubility of the salt. The equilibrium of the system

$$\text{sucrose} + \text{salt} \rightleftharpoons \text{addition compound}$$

is largely dependent on the concentration and dipole moment of the salt ; this relationship can be expressed by the equation

$$\log \Delta L = c_{salt}\, f(\mu)$$

where ΔL is the increase in sucrose solubility, c_{salt} is the concentration of the salt in equiv./litre, and $f(\mu)$ indicates a function of μ, the dipole moment of the salt. Those salts which increase the sucrose solubility have a dipole moment greater than that of the water associated with the sucrose molecule ($1{\cdot}85 \times 10^{-18}$ dynes$^{\frac{1}{2}}$.cm^{2}). Thus those salts, e.g. sodium sulphate, ammonium nitrate, sodium and potassium thiosulphates, which have a dipole moment lower than this will not form addition compounds.

* * *

Paper Chromatograms of Sugars and their Quantitative Evaluation. M. ATHENSTEDT. *Zeitsch. Zuckerind.*, 1958, **83**, 389–391.—The most suitable solvent mixtures and papers for the various techniques of paper chromatography are discussed. Three methods of quantitative evaluation of the sugar in a spot are described, viz. comparison of spot size with a standard, the use of radio-active substances, and colorimetric methods, including the anthrone method for sucrose and the Potterat and Eschmann method[1] for reducing sugars.

[1] *I.S.J.*, 1955, **57**, 204.

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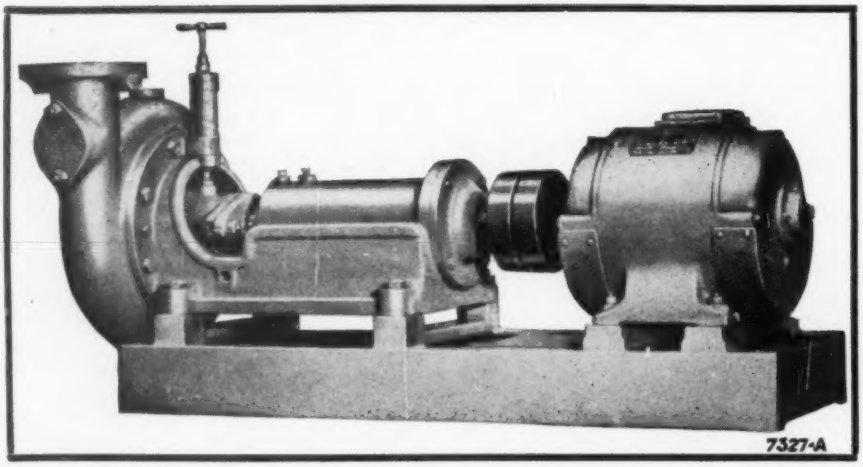

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The Composition of Beet and Juices from the 1957/58 Campaign (in Czechoslovakia). P. PAVLAS and O. MELOUNOVÁ-HÄUSLEROVÁ. *Listy Cukr.*, 1958, **74,** 175–183.—Full details are given of the composition of Czech beets and juices during the 1957/58 campaign. The weight of roots was above average while the sucrose content was normal. The diffusion juices contained a high proportion of nitrogenous non-sugars and increased amides and salts, particularly calcium and sodium, owing to inadequate ripening of the beets. The syrup purities were below the average for the past 38 years and the alkalinity was low and often fluctuating, owing to the inadequacy of the carbonatation technique for dealing with the non-sugars.

* * *

Use of "Versene" (EDTA)—Possibility of Increasing Exhaustibility of Molasses. I. Details of Experimentation and Theory. II. Observations of Saha and Co-Workers Examined. S. N. G. RAO, N. A. RAMAIAH and S. K. D. AGARWAL. *Indian Sugar*, 1958, **8,** 191–204; 205–207.

(I) The effect of EDTA on polarization of sucrose, fructose and glucose solutions to which salts have been added is examined. The polarization is altered by the salts but restored to the original value by the EDTA. When added to molasses the pol increases to an extent corresponding to a purity rise of up to 8–12 units. Inversion of the molasses with acid followed by addition of EDTA also indicated the release of optically active materials (sugars) by EDTA, this effect continuing some time after the initial inversion is complete. The possibility of crystallizing the "released" sucrose from molasses is examined by mixing some molasses with EDTA and concentrating under vacuum to supersaturation. Powdered sugar is added as seed and the mixture stirred for 20–24 hr and centrifuged; the mother liquor purity (determined after addition of EDTA) is reduced by 4·6–11·4 units, compared with the original molasses. A spectrophotometric method of reducing sugar analysis uses the precipitation of Cu_2O from alkaline copper tartrate; this precipitate in arsenomolybdate solution gives a blue colour with an absorption at 660mμ. This technique, used with a molasses sample, before and after inversion, and with and without EDTA addition, indicates the release of sugars by the latter. Examination of the effect of lead sub-acetate addition to molasses before treatment with EDTA indicates that : the amount of lead acetate used controls the rise in purity obtainable with EDTA : NaOH increases the pol of lead-clarified molasses ; and EDTA at pH 9 does not increase the pol of lead-clarified molasses. (These observations follow from a discussion of the chelating action of EDTA).

(II) The observations of Saha *et al.*[1] indicating that no change in polarization occurs with EDTA are refuted, and it is pointed out that techniques used by these workers are not the same as those employed by the authors.

Saponin Content of Sugar Beet. H. LÜDECKE and I. FEYERABEND. *Zucker*, 1958, **11,** 389–393.—The haemolytic method of determining the saponin content of beet was tested and the effect of fertilizers, type of beet, and climate on the formation of saponin was studied. A close relationship was found between saponin formation and sugar formation, both being roughly parallel during plant growth. If an increase in sugar content occurs, due to fertilizers, selection or climatic conditions, the saponin content also increases. Both decrease with increased nitrogen application, while neither phosphoric acid nor potash have any effect.

* * *

Report on Sugar and Sugar Products. E. J. MCDONALD. *J.A.O.A.C.*, 1958, **41,** 620–621.—The determination of surface water in refined sugar is discussed with reference to the latest methods described in the literature. Further work is necessary and a continuing study is recommended.

* * *

Report on Densimetric and Refractometric Methods for Sugars. C.F. SNYDER. *J.A.O.A.C.*, 1958, **41,** 621–622.—Refractive indices of pure sucrose solutions over the range 50–78% w/w in air have been measured and are expressed by the equation :

$$n_{20}^{D} = 1{\cdot}3329877 + 0{\cdot}001410125p + 0{\cdot}00000601507089p^2 + 0{\cdot}0000000123734022p^3$$

where p = % sucrose, w/w, in air.

* * *

Report on Reducing Sugars. E. J. MCDONALD. *J.A.O.A.C.*, 1958, **41,** 623–625.—Synthetic liquid sugars were made from pure components to be representative of the sucrose, medium invert and total invert types. Concentration was by flash evaporator. The syrups were analysed for total solids by refractometer (error +0·06 to +0·22), vacuum drying (error −0·18 to +0·47) and Brix spindle (−0·37 to +0·16 difference from refractometric values); % invert sugar and sucrose by the Munson & Walker and Lane & Eynon methods and sucrose by the Clerget method. The experimental errors were as expected. All the results are tabulated.

* * *

Determination of Invert Sugar by the Lane-Eynon Method using Potassium Ferrocyanide. A. S. SUSHKOVA. *Ukrain. Khim. Zhurn.*, 1958, **24,** 251–253; through *S.I.A.*, 1958, **20,** Abs. 625.—A refinement of the Haddon modification of the Lane & Eynon method is described. The formation of Cu_2O, which obscures the end-point in the presence of methylene blue indicator, is prevented by addition of $K_4Fe(CN)_6$ in powder form. For calculation of the results by the standard Lane & Eynon tables, the titration figures must be multiplied by the correcting factor 1·213 or the concentration of the Fehling's solution altered accordingly. In the latter case, the procedure is : 12·5 ml aliquots of both solution I (84 g of copper

[1] *I.S.J.*, 1959, **61,** 50

sulphate per litre) and solution II (419·6 g of Rochelle salt and 121·3 g of NaOH per litre) are mixed in a 250 ml conical flask ; 0·4 g of powered $K_4Fe(CN)_6$ is added and the flask is rotated to dissolve the powder. About one-fifth of the sugar solution required for the complete titration is measured into the flask from a burette, the flask heated to boiling, and the mixture is titrated within 2—2·5 minutes with the rest of the sugar solution. Methylene blue (2–3 drops of a 1% solution) is added just before the end of the titration. For reproducible results, the concentration of the sugar solution should be such as to require 15–30 ml per 25 ml of modified Fehling's solution.

* * *

Determination of Reducing Sugars in Paper Chromatograms by means of Ceric Sulphate. H. THALER. *Die Nahrung*, 1958, **2**, 111–116; through *S.I.A.*, 1958, **20**, Abs. 626.—The usual analysis with copper reagents is liable to error owing to autoxidation of the cuprous oxide formed in small finely divided or colloidal amounts. This is obviated by application of the ferricyanide and ceric sulphate method. The cut-out portions of the paper chromatogram (several strips) are extracted in a small glass funnel with 15 ml of cold water divided into 3 or 4 portions. The filtrate is put in a 100 × 34 mm Hagedorn tube to which is added 2 ml of alkaline $K_3Fe(CN)_6$ solution (5 g $K_3Fe(CN)_6$, 10·6 g anhydrous Na_2CO_3, in 1 litre). The tube is covered and heated in a boiling water bath for 15 min, cooled in running water for 3 min and, after adding 1 ml of 18*N* sulphuric acid and 7 drops of "Setopalin C" solution, the solution is immediately titrated with 0·0025*N* ceric sulphate solution (from a burette with 0·01 ml graduations) until the colour changes from yellow to a clear gold-brown. A blank test should also be made. The amounts of sugar corresponding to 1 ml of the $Ce(SO_4)_2$ solution are, in µg : maltose 101·6, lactose 120·2, glucose 82·7, mannose 80·7, galactose 103·0, xylose 82·0, fructose 77·6, and arabinose 89·1.

* * *

Protaminobacter rubrum, **A Colour-Forming Bacterium from Sugar Beet.** S. WINDISCH. *Zeitsch. Zuckerind.*, 1958, **83**, 446.—The bacterium, which produces palatinose from sucrose media and which also forms a dark red substance, is further discussed.[1]

* * *

Estimation of Calcium in Sugar House Products using Ethylene Diamine Tetra-Acetic Acid. N. A. RAMAIAH, —. VISHNU and R. K. CHATURVEDI. *Naturwiss.*, 1958, **45**, 290–291 ; through *S.I.A.*, 1958, **20**, Abs. 630.—Molasses, diluted to 10°Brix, is clarified by dry lead subacetate and filtered ; excess lead and interfering metals such as ferric iron are removed by precipitation with $K_4Fe(CN)_6$. The filtrate is acidified with 2 drops of HNO_3 and the calcium present is estimated with the use of ethylene diamine tetra-acetic acid sodium salt by (a) spectrophotometric titration at 630 mµ using copper ammonium complex as indicator, or (b) titration with murexide as indicator. Results by both methods applied to five molasses samples (from different factories) are compared.

* * *

Possibilities of using Fischer's Method in Sugar Factory Analyses. V. RASPER and A. SVOBODA. *Listy Cukr.*, 1958, **74**, 213–214.—The Karl Fischer method[2] was used to determine the water content of raw sugar and refinery products, as well as molasses, beet seeds and dried pulp. A Czech gravimetric method was also used and the results tabulated. It was found that the Karl Fischer method is quick and gives good reproducibility, but it is expensive and requires careful preparation of the reagents and care in the analysis. The use of refractometer is recommended for homogeneous solutions, as it is quicker ; while moisture estimation by measurement of the dielectric constant is recommended for beet seeds.[3]

* * *

Notes on the Estimation of Starch in Sugarcane. K. V. GOPALA AIYAR and K. CHIRANJIVI RAO. *Current Sci.*, 1958, **27**, 218 ; through *S.I.A.*, 1958, **20**, Abs. 714.—The colorimetric method used by Balch[4] and Alexander[5] has been compared with the β-amylase hydrolysis method, as used by Hanes (*Biochem. J.*, 1936, **30**, 168). In both series, the cane material was freed from sugar by through extraction with 85% alcohol. The starch was then extracted with neutral $CaCl_2$ (Balch) or solubilized with alcoholic HCl and extracted with hot water (Hanes). Results for different parts (stem, leaves) of three cane varieties are tabulated. The colorimetric method gave generally lower values than those obtained by the hydrolysis method, though the differences were less marked at higher concentrations, when the variations in values by either method were smaller. The enzyme hydrolysis method is preferred.

* * *

On the Phenolic Content of Sugarcane and (Saccharum) Spontaneum Juices. K. PARTHASARATHI and M. VIJASARADHY. *Current Sci.*, 1958, **27**, 218–219 ; through *S.I.A.*, 1958, **20**, Abs. 715.—Phenols in cane juices are mainly anthocyanin of the rind. The Folin-Denis colorimetric method of estimation was found unsatisfactory, since non-phenolic reducing substances, including glucose, interfere with the colour development. The diazotised sulphanilic acid reagent of Fox and Gange (*J. Soc. Chem. Ind.*, 1920, **39**, 269T) was therefore used. The method is decribed. Figures are tabulated for juices from six canes, values varying from 28 mg (expressed as phloroglucinol) per 100 g of juice from Co 439 cane, to 102 mg for juice from Co 285 cane. For juices from six *Saccharum spontaneum* varieties the range was from 45 to 139 mg per 100 g of juice.

[1] See *I.S.J.*, 1958, **60**, 274.
[2] Cf. *I.S.J.*, 1951, **53**, 157.
[3] CIZ and VALTER: *Listy Cukr.*, 1955, **71**, 70–71.
[4] *I.S.J.*, 1953, **55**, 191.
[5] *I.S.J.*, 1955, **57**, 115.

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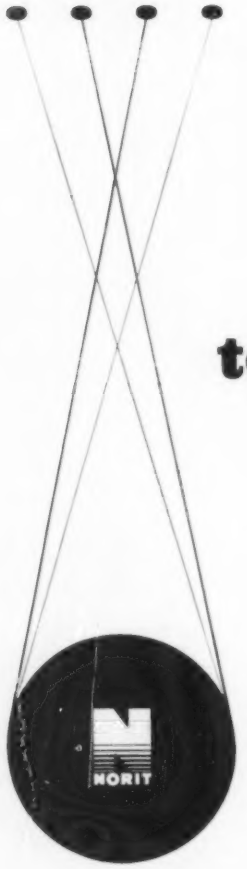

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BY-PRODUCTS

New Method for Depithing Bagasse. ANON. *Sugar J.* (La.), 1958, **21,** (3), 34–35.—See *I.S.J.*, 1959, **61,** 61.

* * *

Why there must be no Delay in the Production of Glutamic Acid and other Similar Lime Separation Products. E. A. MOGIL'NY. *Sakhar. Prom.*, 1958, (8), 19–23.—The properties and uses of glutamic acid and betaine, especially in medicine, are discussed. The need to increase production of these in the Soviet Union is emphasized (at present only a small amount of glutamic acid is produced, and this from sources other than beet molasses). The separation process employed at the San Jose, California, factory of International Minerals & Chemical Corporation is described in detail, with the aid of a diagram.

* * *

Clinical Dextran. H. WIRNER. *Zeitsch. Zuckerind.*, 1958, **83,** 442–445.—The origin and chemistry of dextran are discussed and the properties of clinical dextran and dextran derivatives described.

* * *

Bagasse as Cattle Feed. G. K. DAVIS and W. K. KIRK. *Sugar J.* (La.), 1958, **21,** (4), 12–13, 40.—Feeding trials are described using bagasse pith, ammoniated pith, bagasse/urea mixtures and mixtures with molasses. Pith digestibility was found to be a major problem ; but this was countered by mixing with molasses and other materials such as citrus pulp. Older (2 years +) animals showed better gains in weight than younger animals.

* * *

Sugar for Chickens. M. W. TAYLOR. *Sugar J.* (La.), 1958, **21,** (4), 17–18.—The wetness of droppings produced when feeding low-grade sugar or molasses to chickens is found to be due to a higher quantity of urine than usual and this, it is shown, is not necessarily due to the sucrose in the diet, but might be a result of higher intake of water caused by thirstiness due to the impurities in the molasses.

* * *

T.S.C. Successfully made Hard Fibre Board from Sugar Cane Bagasse. H. S. WU. *Taiwan Sugar*, 1958, **5,** (6), 13–14.—An insulating board factory was built in Taiwan and went into production in 1956. Difficulties were encountered when trying to produce hardboard, but these have been overcome by a development team and the factory, now producing hardboard from bagasse, is the first in the world to do so.

* * *

Considerations of Heat Techniques on "Betfor" Drying Plants. G. ROSENBLAD. *Socker Handl.* II, 1958, **14,** 121–130.—The temperature was measured at the inlet, at the outfall, and at three points along a drum dryer at Teckomatorp for drying molasses-mixed beet pulp. The results lead to a discussion of the efficiency of the drum dryer. With a record of the temperatures inside a drum dryer, it is shown how moistening of the thermometer element by wet material passing through can give anomalous indications. Direct firing can be used for drying with relatively satisfactory heat economy by recirculating waste gases; the dryer drums, however, offer an opportunity for cooling the exhaust gases to a considerably lower temperature than could be attained in the boiler house itself. Consequently, combined drying can be performed with less heat expenditure than direct firing. It should be possible to obtain a decrease of the booster heat requirements by about 10% in existing combined plants by using cooling with exhaust gases instead of air cooling in the booster furnaces. Heat recovery from dryer exhaust gases may also permit considerable savings of fuel, at least in juice stations.

* * *

Mycological Formation of Fat. VI. Synthesis of Fat by Aspergillus nidulans, Penicillium javanicum and Penicillium spinulosum in Shaken Culture. J. M. GARRIDO, A. M. GAD and T. K. WALKER. *J. Sci. Food Agric.*, 1958, **9,** 728–732.—The respective concentrations of NaH_2PO_4, $MgSO_4$ and K_2SO_4 which promote fat formation by the three organisms in shaken culture have been determined. The most suitable sources of nitrogen and levels of nitrogen favourable to fat synthesis have also been ascertained. Under the best conditions, with glucose as substrate, *A. nidulans* produced 14 g of fat per 100 g of sugar consumed, while from *P. javanicum* and *P. spinulosum* the highest yields were 7·9 g and 11·8 g respectively. The highest yields of fat as g/litre of culture broth were *A. nidulans*, 8·9; *P. javanicum* 3·7; *P. spinulosum* 9·1 *A. nidulans* and *P. spinulosum* were also tested on sucrose media and the best yields of fat were : *A. nidulans*, 8·5 g/100g of sucrose consumed and 5·5 g/litre; *P. spinulosum*, 12·2 g/100 g of sucrose consumed and 10·1 g/litre.

* * *

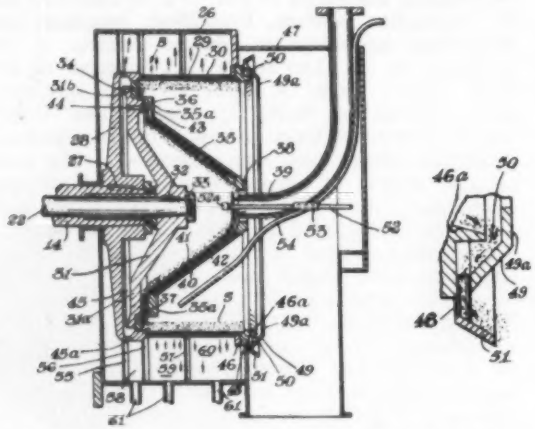
Isolation of "Crude" Clinical Dextran. Fractionatation by Phosphate Precipitation. L. LACKO, J. MÁLEK and J. DVORÁKOVÁ. *Chem. & Ind.*, 1958, 1553–1554.—A new method lowers dextran solubility in dilute alcoholic solutions owing to the presence of added salts; thus the high M.W. fraction is removed by addition of ethanol or acetone, and the crude clinical fraction obtained on "salting out" by addition of phosphate. Fractionation with alcohol is repeated The phosphate added is 600 g per 100 litres of neutral hydrolysate, but alcohol usage is reduced from 63·6 litres to 25·5 litres, with consequent saving in costs, while the dextran recovery and quality are unchanged.

* * *

A Newly-invented Yeast Propagator. H. S. BAH and Y. T. LIU. *Taiwan Sugar*, 1958, **5,** (8), 16–22.—See *I.S.J.*, 1959, **61,** 153.

UNITED KINGDOM

Centrifugals. BAKER PERKINS LTD., of Peterborough, Northants. **808,376.** 2nd December 1955; 4th February 1959.—The driven shaft 14 and keyed reciprocating shaft 22 extend into the "wet housing" 26 of the pusher-type centrifugal. Shaft 14 carries a keyed plate 28 on which is mounted the basket 29 with its screen 30. Shaft 22 carries the frustro-conical plate 31 which itself carries the pusher plate 34 on flange 31*a*. It also supports a distributing funnel 35, bored at the apex 38 so as to admit the feed pipe 39. The funnel is recessed as at 40 to carry screens 41, 42. Massecuite admitted is partially separated, the run-off passing



through pipes 43, 44 into the space 45 behind the plate 31 which communicates by way of ports 45*a* with the chamber 58. The sugar crystals passing on are distributed from the funnel 35 onto the basket screen 30 and are pushed along and out through the gap 50, 51, passing baffles 49 which serve to mix the inner layer nearest the axis of the basket (which may contain 1–2% of moisture) with the outer layer furthest from the axis (which may contain 4–5%). Wash liquid may be supplied to the funnel through pipe 52 and nozzle 52*a*, and to the basket through pipe 54 ; partitions 55, 56, 57 divide the outer chamber into sections so that the molasses and washes may be kept separate.

* * *

Beet Harvester. D. R. MANSHOLT, of Slootdorp, Holland. **808,890.** 11th February 1957 ; 11th February 1959.

Continuous Treatment of (Beet) Waste Waters. V. JONAS, of Prague, Czechoslovakia. **808,905** ; **808,906.** 23rd September 1955 ; 11th February 1959.—A continuous fermentation tank consists of a cylindrical vessel which may be provided with a vertical spiral partition and an inlet port at the outside edge of the tank, near the junction with the edge of the partition. Liquid entering the tank passes round in a spiral path from the periphery to the centre, leaving through an exit port at the tank bottom. Alternatively the tank is provided with a number of concentric partitions, connected by cross-partitions staggered with respect to each other, and with slots in the concentric partitions between the junctions with adjacent cross partitions. Thus, liquid entering the annular chamber formed by the tank wall and the outermost circular partition passes around it and is directed by the cross-partition through the slot into the next inner annular chamber. The liquid passes round this and is directed by the second cross-partition through the second slot into the next inner annular chamber, finally entering the central chamber which it leaves by the exit port.

Waste water is passed through a meter and into such a fermentation tank, a fermentation agent, nutrients, etc., being added, in proportion to the quantity of water metered, as well as a supply of air. The liquid discharged is sent, via a filter to collect the mycelium, to a clarifier provided with a sand catcher and milk of lime added. The clarified water is then treated with CO_2 and sent to a continuous decanter where the albuminocalciferous sludge is separated, thickened and dried while the purified water passes on. Some of the sludge may be returned continuously to the diffusion clarifier, and some of the mycelium may be continuously returned to the fermentation tank.

* * *

Recovery of Sucrose Esters. DISTILLERS CO. LTD., of Edinburgh, Scotland. **809,815.** 4th September 1957; 4th March 1959.—Reaction mixtures containing sucrose mono or diesters, prepared e.g. by transesterification of alkyl esters with sucrose, are treated so as to remove at least 90% of the organic solvent and the residue treated with water. The aqueous phase is adjusted to a pH below 7 (pH 3–4), maintaining at a temperature below 20°C (0–5°C) and the esters separated by filtering or centrifuging.

* * *

Hydrolysis of Pyrrolidone Carboxylic Acid in Alkaline Liquids (Beet Wastes). N. V. CENTRALE SUIKER MIJ.,

Copies of Specifications of United Kingdom Patents can be obtained on application to H.M. Patent Office, 25 Southampton Buildings, London, W.C.2. (price 3s. 6d. each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C. (price 25 cents each).

of Amsterdam, Netherlands. **810,851**. 13th August 1956; 25th March 1959.—The yield of glutamic acid obtained by alkaline hydrolysis of concentrated liquids containing pyrrolidone carboxylic acid at elevated temperatures is considerably increased, to practically quantitative, by adding 11—16% of solid NaOH (or the equivalent weight of other solid alkali hydroxide) by weight of the concentrated liquid.

* * *

Glutamic Acid Purification. KYOWA HAKKO KOGYO K. K., of Tokyo, Japan. **811,688**. 19th March 1957; 8th April 1959.—An impure solution of glutamic acid, e.g. Steffen's waste, is passed through a strongly acidic cation exchange resin which first of all adsorbs cations and amino acids. Since glutamic acid has the least affinity of these for the resin, it is eventually displaced by continued feeding of liquid to the column, so giving a glutamic acid-enriched effluent. This effluent is passed to a second column of strongly basic anion-exchange resin which adsorbs the anions and acidic amino-acids. Since glutamic acid has the least affinity of these for the resin it is again displaced by continued feeding of liquid to the column, so giving an effluent containing mainly glutamic acid and some other amino-acids. This mixture is passed through a column containing a weakly basic anion exchange resin which adsorbs the glutamic acid and other amino-acids; on elution with an acid, a fraction rich in glutamic acid is obtained from which the glutamic acid can be crystallized on adjusting to pH 3·2. The strong ion exchange resins may be used in the reverse order to that above, or may be used as a mixed bed.

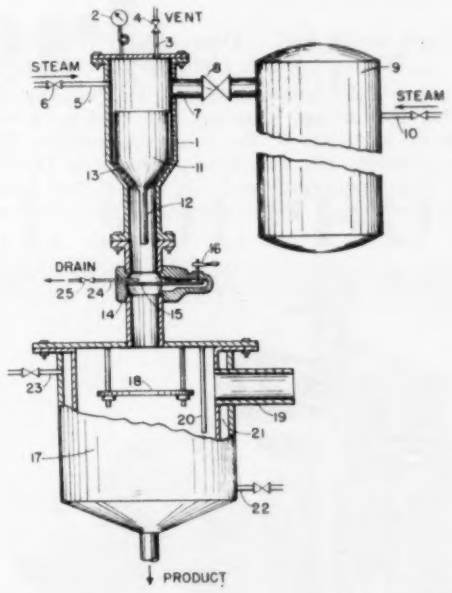
* * *

Hydrolysing Dextran. COMMONWEALTH ENGINEERING CO. OF OHIO, of Dayton, Ohio, U.S.A. **811,770**. 27th December 1956; 8th April 1959.—Clinical dextran is produced by heating a (10%) solution in aqueous (sulphuric) acid (of pH 1·2—1·26), of high M.W. native dextran, in the presence of 2·5—33⅓% (7–10%) of a non-solvent (*iso*-propanol, EtOH, MeOH, or acetone) by weight of water present, (and in the presence of 0·3% of ascorbic acid as a reducing agent), at the boiling point of the mixture, until the high M.W. dextran is hydrolysed to a dextran having a M.W. in the desired range.

* * *

UNITED STATES

Processing of Sugar Beets. L. E. BROWNELL and S. A. ZIEMINSKI, of Ann Arbor, Michigan, U.S.A., assrs. U. S. SECRETARY OF AGRICULTURE. **2,873,220**. 14th October, 1953; 10th February 1959.—In an autoclave 1, a container 11 is used to hold beet cossettes. These are preheated by steam admitted through pipe 5, valves 8 and 16 being closed. Any condensate is removed through drain 24. Steam is admitted through pipe 10 into reservoir 9 which has a volume ten or more times that of the autoclave. On opening the rapid-acting valve 8 the steam passes through pipe 7 into the autoclave raising the pressure very quickly. When the rapid acting valve 16 is opened the high-pressure steam in 1 drives the cossettes in 11 downwards through nozzle 12 and so at high speed against the baffle 18 in chamber 17. Gasket 13 prevents passage of high-pressure steam from 1 to 17



around container 11. The chamber 17 may be vented to air or evacuated through pipe 19 which is fitted with baffle plate 20 to prevent loss of beet, and it is water-cooled by means of jacket 21. The disintegrated beet material is removed from the bottom of chamber 17 by the pipe shown.

* * *

Anion Exchange Resin for Sugar Decolorization. E. F. RIENER, assr. ROHM & HAAS CO., of Philadelphia, Pa., U.S.A. **2,874,132.** 2nd November 1956; 17th February 1959.—An insoluble quaternary ammonium resin is the product of reaction of a tertiary amine with the condensation product of (a) a copolymer of a mixture of a major amount of an aromatic monovinyl benzene (styrene) with a minor amount of a divinyl hydrocarbon (divinyl benzene) and (b) a haloalkylating agent which provides halo-alkyl groups of the general formula $C_nH_{2n}X$ where $n = 1$–4 and X is Cl or Br (CH_3Cl or CH_2Br). Condensation of (a) and (b) is carried out in the presence of an acetal of the general formula $R'R''C(OR''')(OR'''')$ where R' and R'' are either hydrogen atoms or alkyl groups, R''' and R'''' are alkyl groups, and $R' + R''$ have a total of 1–8 carbon atoms (1,1–dimethoxymethane, ethane, butane or nonane, or 2,2–dimethoxyhexane), the acetal being present in the proportion of 10–40% of the copolymer.

* * *

Cane Piler. S. A. THORNTON, of Jeannerette, La., U.S.A., assr. S. A. THORNTON, JR., of Alexandria, La., U.S.A. **2,874,854.** 9th June 1954; 24th February 1959.

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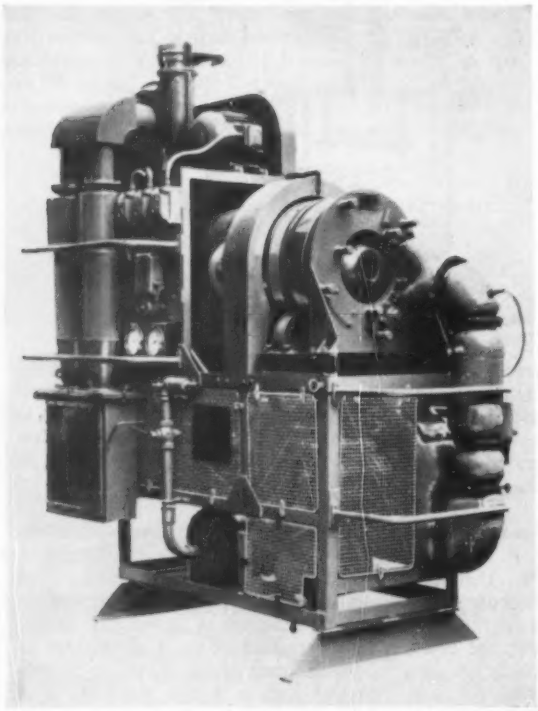
A small self-contained drying and cooling unit suitable for drying, roasting and cooling a wide range of materials in the form of powders, filter cakes, granules, etc., has been produced by Dunford & Elliott as a packaged version of their Rotary Louvre continuous dryer. The new model is a compact and



versatile unit which can be used for carrying out tests as a preliminary to full scale processing or for the rapid and continuous handling of small quantities of materials. It has a maximum holding capacity of approximately one cubic foot of material and the drying time may be varied between five minutes and sixty minutes to suit the moisture content and the type of material to be processed.

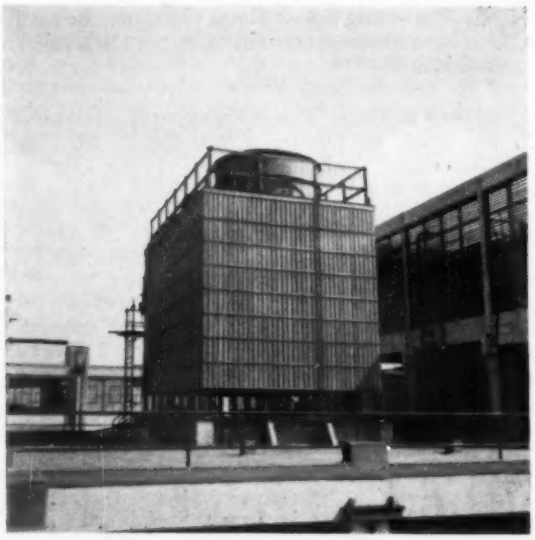
The fitted instruments include an air flow meter and temperature indicators for both inlet and exhaust. All the parts of the drum which come in to contact with the material are made of stainless steel and the life of these parts is very long owing to the complete absence of abrasion. Maintenance costs are therefore reduced to a minimum.

The dryer is supplied ready for operation, it being merely necessary to connect one electrical and one gas point. Alternative heating arrangements by means of electricity, oil or an indirect air-steam heater can be provided if required.

* * *

Water Cooling. Film Cooling Towers (1925) Ltd., Lionel Road, Kew Bridge, Brentford, Middlesex.

The Mechanical Cooling Tower of the induced draught type provides a means of water cooling which is efficient, economical to operate and which occupies the smallest possible space. In this type of structure the fans are situated at the top and cause the air to enter the base of the tower at a relatively slow speed and to leave from the top at high velocity. The advantages are that the incoming air is circulated more evenly through the packing and that recirculation is not likely to occur. The "Film Flow" system, which provides maximum heat transfer with a low capital outlay, distributes the liquid evenly over the packed area of the tower.



This method of distribution ensures that the entire surface of the packing is evenly wetted, providing a very high heat exchange, which together with the fact that the cooling air has a relatively unimpeded flow throughout, effects an economy in the cost of the power to drive the fans. Also, by completely avoiding the formation of water drops, there is a smaller loss of water by entrainment and the use of baffle plates and drift eliminators is unnecessary.

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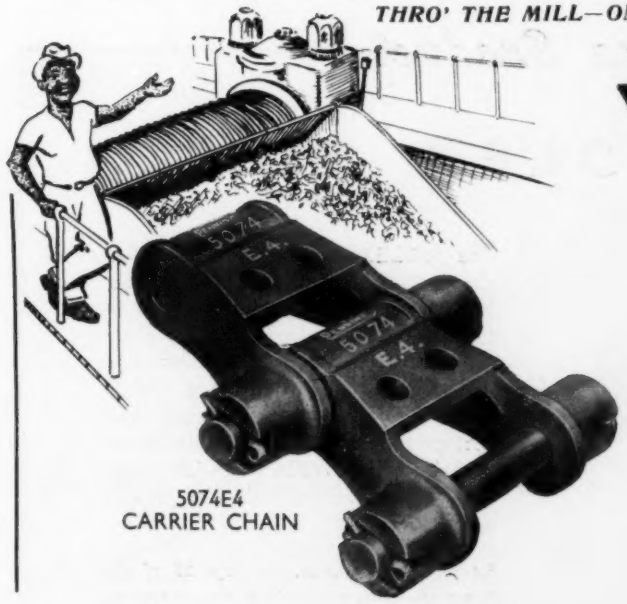
THRO' THE MILL—ON PENNINE CHAIN



5074E4
CARRIER CHAIN

well-fed rollers

Intermediate carriers feeding cane fibre between mill rollers have to withstand severe wear during grinding seasons, and Pennine 5074E4 Chains, for double-sprocket use, are highly recommended for this service.

Heavy outside driving lugs give longer wear. The twin attachment holes are equidistant from pins for slat assembly with laps leading or trailing.

Other roller and pintle chains suitable for intermediate carrier work can also be supplied.

Sugar production runs smoother on Pennine chain

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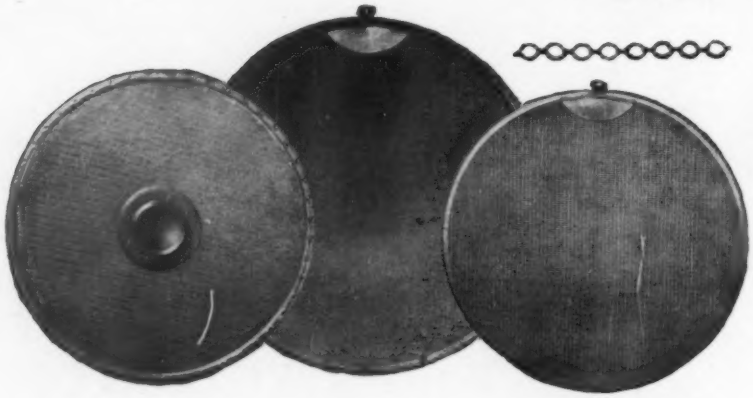

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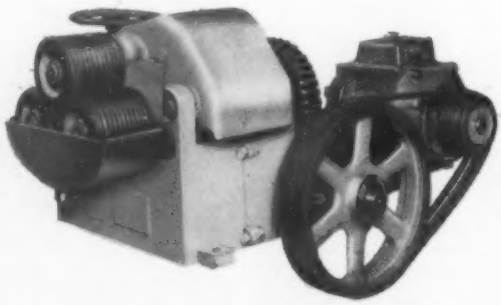

The illustration shows a ROLEX mill belt-driven by a 3 h.p. electric motor.

The **ROLEX** laboratory three-roller cane mill has recently been improved. The 5" x 5" rolls and body are now in Meehanite cast iron and the spur gears are of steel. Otherwise the general lay-out is as formerly. The top roll is adjustable, oilite bearings fitted, and 20:1 gear ratio. Scrapers are also fitted to both bottom rolls. The juice tray and scrapers are removable for general cleaning.

For further information, see page 26 of the Suma catalogue, which will be sent on request.

The Sugar Manufacturers' Supply Co. Ltd.

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Cables : "Sumasuco, London."

Packing depth can be reduced in some cases by as much as 50% of the space required by the normal drip bar packing system, giving lower capital costs and in the power required to obtain the pumping head.

Induced Draught Towers incorporating the "Film Flow" packing system can be constructed with shells of reinforced concrete, asbestos cement tile, steel or timber according to requirements and local conditions.

* * *

Automatic Sampling of Bulk Granular Materials. Birtley Engineering Ltd., Birtley, Co. Durham.

Birtley sampling units operate at points where the material to be sampled falls freely and thereby obtain, in each increment-take, a cut across the full width and depth of the material stream, with no sizing bias. The weight and frequency of increments are determined in accordance with the British Standard Specification and/or the requirements of the industry concerned. A number of installation arrangements are possible with the equipment shown in the drawing which shows a typical Birtley light-duty swing-arm sampler, installed on the head end of a conveyor.

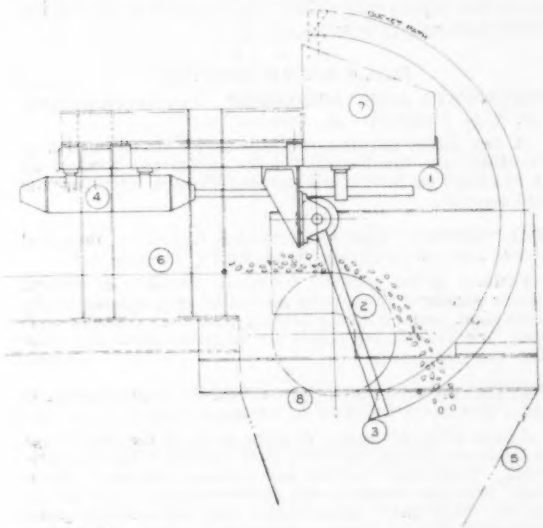


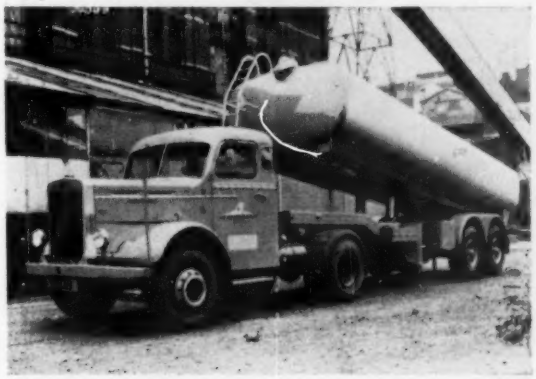
Fig. 1. Key. (1) Baseplate ; (2) Swing arm ; (3) Bucket ; (4) Electric actuator ; (5) Chute ; (6) Conveyor ; (7) Collecting bin ; (8) Head drum.

In the Birtley slotted-belt sampler design increment taking is achieved by means of suitable apertures in the "conveyor" belt of the sampler, an increment of predetermined proportions being obtained on each coincidence of the material feed with a belt aperture. Reject from the sampling process, i.e. the main material is conveyed on to any required point. This sampler has two main applications : (a) as a feeder conveyor and primary sampler simultaneously, and (b) as a secondary sampler, in conjunction with a swing arm type, in the case of high capacity plants.

* * *

Bulk Sugar Road Tanker. Leyland Motors Ltd., Leyland, Lancs.

The articulated tanker shown is operated by Alb. Keyzer en Zoon N.V. of Zaandam, Holland, for transporting 15–16 tons of refined sugar at a time, with consequent savings in handling costs. The tractor part of the unit is a 150 h.p. Leyland "Super Beaver" with an automatic gear change, while the tank, mounted on a "Netam" tandem-axled semi-trailer, is constructed of stainless steel, completely



insulated and surrounded by an aluminium jacket. Sugar is loaded from a silo through a manhole at the front of the tank which is held in a tipped position by hydraulic rams while hydraulic legs support the semi-trailer. Power for this operation is supplied by a small petrol engine mounted on the trailer. Three other manholes are available on the top of the tank. A manually-operated valve at the back of the tank is used to discharge the sugar while the tank is tipped to its maximum angle of 45°.

* * *

Devcon Plastic Steel. E. P. Barrus Ltd., 12-16 Brunel Road, Acton, London W.3.

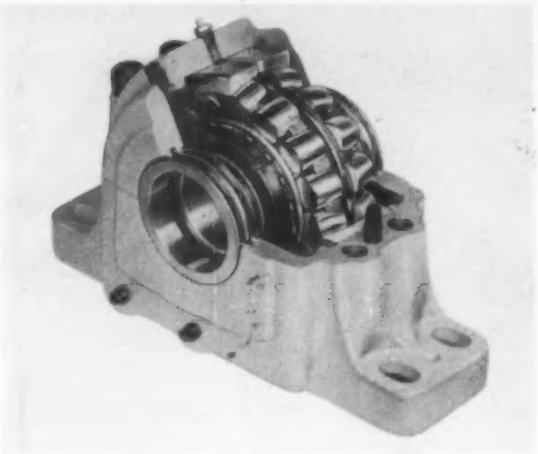
Plastic steel is a combination of approximately 80% steel and 20% of a special plastic. Two types are available ; "Devcon A", a non-sagging putty, and "Devcon B", a semi-viscous liquid which can be poured. A hardening agent is added and in two hours the material has formed an extremely strong, tough and rigid metallic piece, without heat or pressure. Plastic steel makes a precision form of an original, and can be sawn, drilled, tapped, threaded and ground, etc. It has good abrasion resistance and will bond steel, iron, aluminium, brass, bronze, lead, porcelain, glass, wood, concrete and many other materials. The plastic steel finds great use in repairing leaks or cracked castings in pipes, tanks, valves, etc. Other

products include "Devcon F" aluminium putty, "Devcon WR" wear-resistant material, and "Devcon C" heat resistant material.

* * *

Spherical Roller Bearings. Link-Belt Company, Prudential Plaza, Chicago 1, Ill., U.S.A.

Features of the series 22200 and 22300 bearings are : maximum diameter and quantity of convex rollers for each bearing size ; precision-machined centrifugally-cast bronze retainers, and high, heavy inner race shoulders. Bore sizes range from 1·5748 to 11·0236 inches, with dynamic load ratings up to



288,000 pounds, in the case of shaft mounted bearings, while bearings mounted as shown in a pillow block range in bore size from 1 $\frac{7}{16}$ to 10 inches. The bearings are claimed to give trouble-free operation at high speeds, low operating temperature and noise level, and are provided with centre groove lubrication. A range of suitable seals is provided for use in pillow-blocks with a variety of applications.

* * *

The Landmaster L.150. Landmaster Ltd., 12–15 Dartmouth Street, London S.W.1.

This new machine, developed to meet the needs of small farmers, is a moderately priced rotary cultivator which can be adapted to a number of other purposes. It is driven by a 160 cc two-stroke engine developing 4 h.p., with a two-speed gear and chain transmission. The handlebars are adjustable. When used as a cultivator, as shown, the machine is fitted with two pairs of 4-bladed rotors mounted on a hexagonal shaft and having a cultivating width adjustable between 27 and 33 inches, or alternatively with a single pair of 6-bladed rotors having a minimum cultivating width of 7$\frac{1}{2}$ inches. The wheel support frame is provided with depth control wheels and reversible skid, or a 12–20 inch ridger may be also mounted.

When not used as a cultivator, the rotors are replaced by a pair of pneumatic tyred wheels, fitted with strakes for soft soils, and the skid with a reversible plough, rake, 7 cwt trailer, cutter bar or tool bar to carry tines, hoe blades, seeding boxes, etc. In

addition, a 2-inch self-priming pump may be mounted on the front weight bracket, operated by belt drive from the engine p.t.o. shaft, and capable of delivering 6000 gallons per hour.

* * *

PUBLICATIONS RECEIVED

"STONWATA A-300" DEIONIZER. Loughborough Glass Co. Ltd., Loughborough, Leicester.

A new leaflet describes the new model for production of "distilled" or "conductivity" water, which can produce up to 30 gallons per hour at low cost, and is easy to install, operate and maintain.

* * *

THE "SEXTET" VARIABLE SPEED PULLEY. Industrial Drives Ltd., 105 Uxbridge Road, Ealing, London W.5.

Features of the "Sextet" drives are simplicity of control, infinite variation, spline drive instead of keys, electrolytic dry lubrication, variable spring loading, maximum diameter shaft sizes, and close-fitting covers for complete protection from dirt and rust.

* * *

POWER TRANSMISSION EQUIPMENT. Crofts (Engineers) Ltd., Thornbury, Bradford 3, Yorks.

A new series of leaflets describe some of the wide range of Crofts equipment, including their stationary field magnetic clutch, "Croft-ring" flexible and resilient couplings, "Radiation" universal mounting and double-reduction worm geared motors, "Multispeed" geared motor units and reduction gears, emergency slipping devices, magnetic clutches and brakes, and also their fabricated steel conveyor pulleys and ancillary equipment.

* * *

CONVEYORS AND REMOTE CONTROLS. Teleflex Products Ltd., Basildon, Essex.

Among the conveyor systems produced by Teleflex are cable, chain and gravity rail assemblies for suspended objects and also slat and belt conveyors and gravity roller conveyors. In special installations, skip hoists, hoppers, vibratory feeders, bucket elevators and belt conveyors can be provided. Remote control equipment described in new leaflets include industrial applications to switchgear, valves, throttles, etc., the Teleflex industrial actuator being available in two series developing 1500 lb and 3000 lb output at 12 inches stroke respectively, by means of a totally enclosed electric motor.

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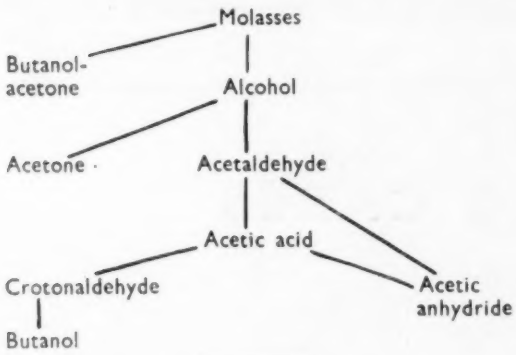

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★ 675 kW 400 volts 3 phase 50 cycles 4-wire back pressure type STEAM TURBO ALTERNATOR SET incorporating turbine by *Belliss & Morcom*, 150 p.s.i. initially exhausting against 12 lb. back pressure. It is also suitable for 500 kW when supplied with steam at 200 p.s.i. and 30 lb. back pressure. Direct coupled through *David Brown* gearbox to alternator by *Brush Electrical*. With switchgear.

★ 400 kW 400/440 volts 3 phase 50 cycles 4-wire *Belliss & Morcom/English Electric* STEAM ENGINE DRIVEN ALTERNATOR SET incorporating compound engine with h.p. cylinder 17″ bore, l.p. cylinder 27″ bore x 12″ stroke, speed 375 r.p.m. Developing 570 h.p. with dry saturated steam at 150 p.s.i. and 7 lb. back pressure. Direct coupled to alternator, complete with switchboard and automatic voltage regulator.

★ 300 kW 375 kVA *Belliss & Morcom/Electric Construction Co.* STEAM ENGINE DRIVEN ALTERNATOR SET incorporating vertical enclosed 2-crank compound engine, 'V' type valves with h.p. cylinder 18″ bore, l.p. cylinder 26″ bore x 11½″ stroke. Engine designed to develop 430 h.p. when running at 375 r.p.m. and when supplied with dry steam at 90 p.s.i. at the stop valve. Engine also suitable for the same output with steam at pressures up to 150 p.s.i. and back pressures up to 20/25 lb. Direct coupled to alternator wound for 400/440 volts 3 phase 50 cycles, complete with exciter, switchboard and automatic voltage regulator.

★ 250 kW 440 volts 3 phase 50 cycles 4-wire STEAM ENGINE DRIVEN ALTERNATOR SET comprising: vertical enclosed 2-crank compound engine by *Belliss & Morcom*, with h.p. cylinder 16½″ bore, l.p. cylinder 23″ bore x 11″ stroke. Engine rated to develop 368 h.p. 10% overload when supplied with dry saturated steam at 150 p.s.i. initially, exhausting against 10 lb. back pressure. Direct coupled to alternator by *Metropolitan Vickers*, complete with exciter and switchboard with automatic voltage regulator.

★ 170 kW *Belliss & Morcom/Harland* 440 volts 3 phase 50 cycles STEAM ENGINE DRIVEN ALTERNATOR SET incorporating: vertical 2-crank twin cylinder engine having cylinders 12″ x 12″ bore x 9″ stroke. Engine rated to give the above output when supplied with steam at 150/160 p.s.i. and 15 lb. back pressure. Direct coupled to alternator with exciter and complete with switchboard with automatic voltage regulator.

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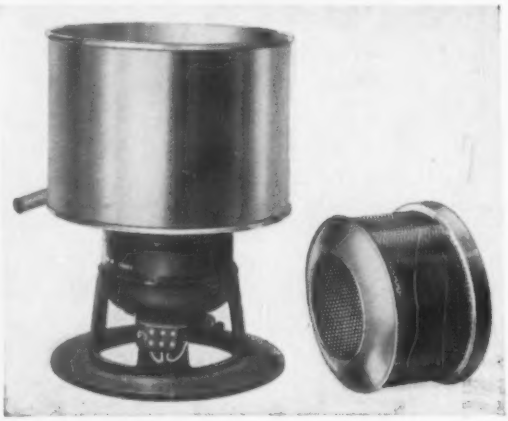
A Suma Product

LABORATORY CENTRIFUGE



This robust electrically-driven centrifuge operates at speeds variable up to 1750/2000 revs. per min. The basket has ⅛ in. perforations, and comes in two sizes: 6 in. diam. by 4 in. deep or 8 in. diam. by 6 in. deep. Both it and the casing are constructed entirely of Monel metal. The equipment is supplied complete with electric motor and regulator.

When ordering, please state A.C. **single-phase** voltage and frequency.

A hand-operated model is also available.

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WORLD SUGAR CROP ESTIMATES[1]

(Thousands of long tons, raw value).

BEET—	1956/57	1957/58 *Partly Est.*	1958/59 *Estimated*
Germany, West	1,139	1,561	1,825
East	479	850	860
Czechoslovakia	649	865	885
Poland	848	1,159	1,205
France	1,380	1,547	1,583
Belgium	322	378	448
Holland	351	389	569
Denmark	339	361	394
Sweden	277	325	265
Italy	956	853	1,095
Spain	394	327	483
Switzerland	33	38	37
Albania	10	13	13
Jugoslavia	163	257	193
Bulgaria	117	148	130
Roumania	169	210	220
Austria	211	279	265
Hungary	263	272	295
U.K.	750	606	778
Eire	96	117	130
Turkey	302	350	382
Finland	32	32	38
U.S.S.R.	4,700	4,815	5,770
Total Europe	13,980	15,752	17,863
Iran	90	90	100
Japan	67	102	112
U.S. (Beet)	1,751	1,934	1,964
Canada	125	128	165
Uruguay	22	32	32
Total Beet	16,035	18,038	20,236
CANE—			
Cuba	5,582	5,687	5,581
San Domingo	714	756	822
Haiti	63	63	65
Mexico	1,138	1,117	1,432
Fr. W.I.	180	201	197
Colombia	256	259	236
Venezuela	203	160	175
Brazil	2,213	2,620	3,101
Argentina	716	646	997
Peru	697	727	770
Other C. & S. America	366	395	422
	12,128	12,631	13,798

CANE—*continued*	1956/57	1957/58 *Partly Est.*	1958/59 *Estimated*
U.S. (Cane)	482	476	504
Hawaii	1,004	732	982
Puerto Rico	884	833	988
Philippines	1,020	1,243	1,247
Virgin Is.	12	9	12
	3,402	3,293	3,733
Br. Guiana	285	306	305
Br. W.I.	834	776	842
South Africa	758	857	1,011
Australia	1,187	1,253	1,350
Fiji	134	196	193
Mauritius	562	550	517
Br. E. Africa	100	130	140
	3,860	4,068	4,358
Madeira & Azores	10	10	10
Spain (Cane)	30	30	30
	40	40	40
Egypt	320	325	320
Réunion	177	205	162
Madagascar	26	56	65
Angola	59	59	60
Mozambique	147	166	155
Belgian Congo	18	18	18
Ethiopia	26	30	35
	773	859	815
India & Pakistan—			
(Whites, r.v.)	2,480	2,620	2,580
(Gur, r.v.)	2,340	2,070	1,890
Indo-China	4	6	6
Burma	39	60	75
China	750	925	1,300
Indonesia	920	825	800
Taiwan	889	951	855
Japan	36	40	46
Thailand	54	63	75
	7,512	7,560	7,627
Total Cane	27,715	28,451	30,371
Total Beet and Cane	43,750	46,489	50,607

West German Sugar Production, 1958/59[2].—The beet area in West Germany totalled 289,417 hectares, and yielded a crop which, with 676,736 tons of imported beet, totalled 12,657,598 metric tons. From this quantity was made 1,379,332 tons of white sugar, 322,945 tons of raw sugar and 3766 tons of syrup.

* * *

Réunion Sugar Production[3].—The 1957 crop was a record with 208,374 tons of sugar produced from 1,734,000 tons of cane. In 1958, however, extraordinarily bad weather conditions and heavy attacks by pests and diseases have reduced the sugar production by about 20%, the cane crop now being estimated at 1,483,000 tons and sugar at 164,700 tons. Local consumption is increasing and is estimated at 8000 tons compared with last year's estimate of 6000 tons which was found to be insufficient.

* * *

Flood Damage in Madagascar[4].—Widespread floods following disastrous storms which swept Madagascar recently are reported to be receding. No estimate of damage to property and crops has yet been made but it is feared that up to 40% of the sugar crop has been destroyed.

Iraq Sugar Imports[5].—Imports totalled 170,301 metric tons, tel quel, in 1958, compared with 140,743 tons in 1957. Principal suppliers were the U.K. (92,615 tons) and Taiwan (14,233 tons).

* * *

British Guiana's Record Sugar Crop[6].—Final figures for the 1958 sugar crop in British Guiana put it at 306,361 tons, representing an increase of 21,640 tons on the previous record set up in the preceding year. The Rose Hall factory with 43,675 tons topped the list of mills and was followed by Diamond, with 39,970 tons ; both Albion and Enmore exceeded 33,000 tons. By estates the leader was Diamond (35,435 tons) followed by Enmore (33,150 tons), Rose Hall (29,823 tons) and Uitvlugt (28,265 tons). The crop was harvested on 15 estates and crushed in 12 factories. In the Budget introduced on January 8th an export duty of $BWI 1 a ton on sugar which had been in abeyance since 1952 was reintroduced.

[1] C. Czarnikow Ltd., *Sugar Review*, 1959, (401), 70.
[2] *Zeitsch. Zuckerind.*, 1959, **84**, 146.
[3] F. O. Licht, *International Sugar Report*, 1959, **90**, (Supp. 6), 68.
[4] C. Czarnikow Ltd., *Sugar Review*, 1959, (400), 64.
[5] F. O. Licht, *International Sugar Report*, 1959, **90**, (Supp. 6), 91.
[6] *Commonwealth Producer*, 1959, (370), 69.

BREVITIES

Sugar Production in India[1].—Indian sugar production is expected to amount to only 1,850,000—1,875,000 long tons in 1958/59, equivalent to 2,088,000—2,116,000 metric tons, raw value. Previous estimates were 2,280,000 metric tons, raw value, and it thus appears that India will not have any exportable surplus. Consequently, during most of 1959, sugar exports of any consequence are not expected unless the Government is pressed by other considerations such as foreign exchange needs. This situation may alter in December when 1959/60 crop sugar becomes available. During the third Five-Year Plan, sugar production is to be increased to 3 million tons of white sugar and 5 million tons of gur and khandsari.

* * *

United States National Committee on Sugar Analysis. The U.S. National Committee, affiliated to ICUMSA, has just announced the election of its officers for the period 1958–1962. Chairman is Dr. R. A. McGINNIS, P. F. MEADS is Vice-Chairman and J. L. HICKSON is Secretary-Treasurer. Referees and Associate Referees have been appointed for the subjects covered by the Committee and these, together with a special board of qualified consulting referees, are available from the office of the Secretary-Treasurer, c/o Sugar Research Foundation Inc., 52 Wall Street, New York 5, N.Y., U.S.A.

Stock Exchange Quotations

CLOSING MIDDLE

London Stocks (*at 19th May*, 1959)

Anglo-Ceylon (5s)	17/7½
Antigua Sugar Factory (£1)	17/–
Booker Bros. (10s)	30/–
British Sugar Corp. (Ltd. (£1)	20/–
Caroni Ord. (2s)	5/–
Caroni 6% Cum. Pref. (£1)	17/6
Distillers Co. Ltd. (6s. 8d units)	27/–
Gledhow Chaka's Kraal (£1)	72/–
Hulett & Sons (£1)	81/3
Jamaica Sugar Estates Ltd. (5s units)	6/10½
Leach's Argentine (10s units)	16/–
Reynolds Bros. (£1)	55/–
St. Kitts (London) Ltd. (£1)	57/6
Ste. Madeleine (Ord.) (£1)	34/–
Sena Sugar Estates (10s)	23/6
Tate & Lyle (£1)	48/6
Tate & Lyle Investments Ltd. (5s)	16/3
Trinidad Sugar (5s stock units)	32/6
United Molasses (10s stock units)	34/3
West Indies Sugar Co. Ltd. (£1)	26/3

CLOSING MIDDLE

New York Stocks (*at 18th May* 1959)

	$
American Crystal ($10)	39⅝
Amer. Sugar Ref. Co. ($100)	35
Central Aguirre ($5)	22⅝
Cuban American ($10)	25½
Great Western Sugar	27½
South P.R. Sugar	25¼
United Fruit Co.	39½
West Indies Sugar Corp. ($1)	42¼

Chile Sugar Production[2].—Sugar production in the three beet sugar factories in operation this year is expected to reach 47,000 tons, an increase of 50% on 1958 production. Domestic sugar will supply about 22·6% of consumption in 1959 compared with 15·1% last year. Output is expected to rise to about 75,000 tons within three years.

* * *

Sugar in Nigeria[3].—A sugar investigation syndicate has been formed by the Federal Government, the Northern Nigeria Government, the Northern Region Development Corporation and Bookers Sugar Co. Ltd., of London and British Guiana. The purpose of the syndicate is to conduct an experiment to determine if good sugar cane can be grown along the southern bank of the River Niger, between the Oshin River and the Shonga district of Ilorin Province, where there is a stretch of flat marshy land. The experiment is being financed largely by the N.R.D.C. and Bookers, while the Northern Government is supplying agricultural and other services. The Nigerian Government will supply meteorological services. Planting began in mid-January and four varieties of cane are being tested. Two are from India, and one each from Java and Barbados. It is hoped that the experiment may provide useful statistical results by June 1960. An official statement has indicated that soil experts from the United Kingdom are also going to Nsukka (Eastern Region) to investigate the possibility of establishing a sugar industry along the Anambra creeks.

* * *

New Sugar Consultant Company.—American Factors Ltd., the largest sugar producing group in Hawaii, have entered the sugar consulting and management field by forming a subsidiary corporation, American Factors Associates Ltd., who will make available members of the plantation staffs for international consulting assignments and also will give training to personnel of other sugar companies on American Factors plantations, on a fee basis. All types of activities from the development of field irrigation systems, mill operation, personnel management and financial guidance to mechancial cane cutters are included. The new company will maintain offices in San Francisco and also at Fort and Queen Streets, Honolulu.

* * *

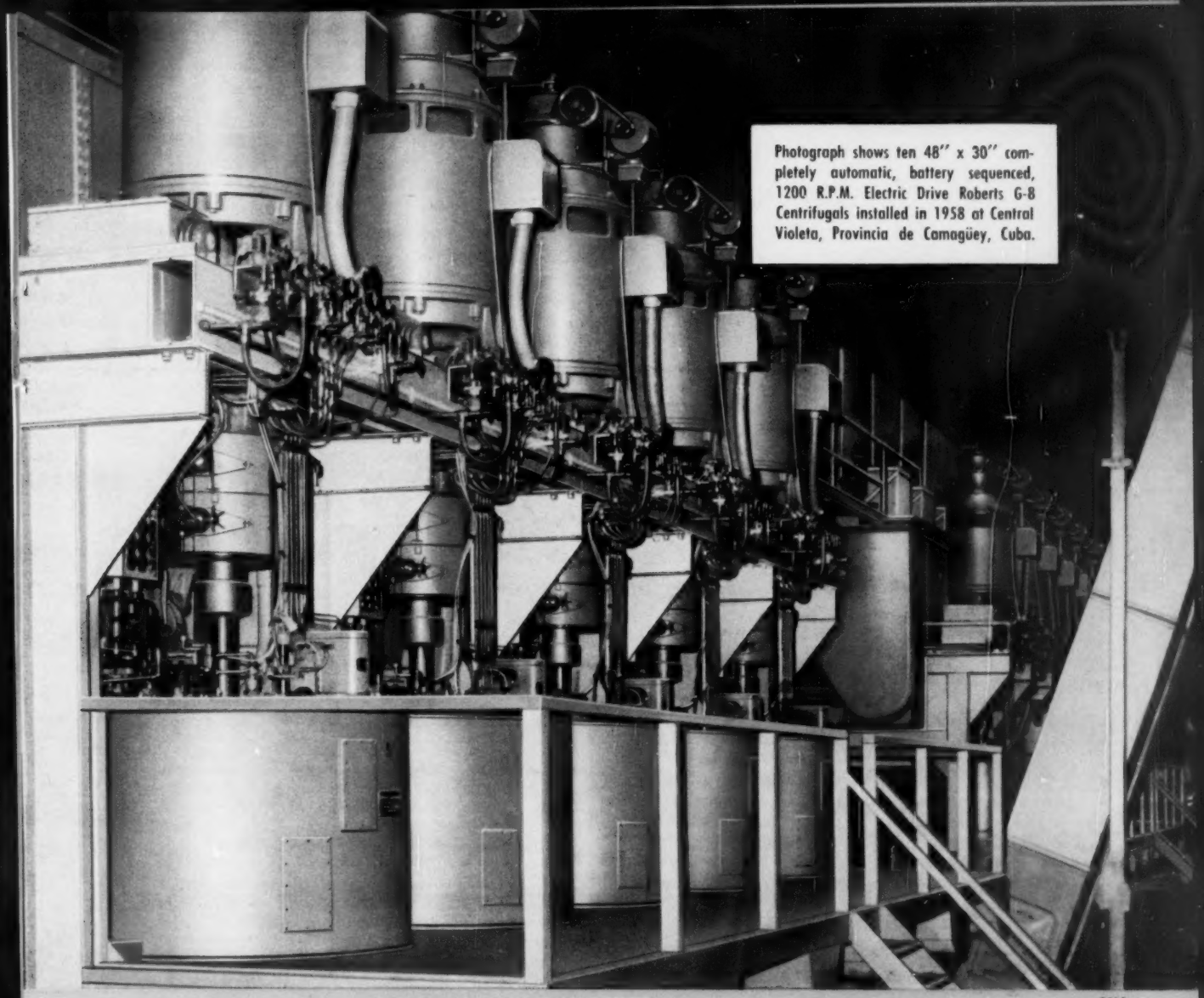
Bagasse Paper Project in the Philippines[4].—Three projects for the production of depithed bagasse fiber, pulp, paper and newsprint, representing a total outlay of $7,125,000, will be launched by a group of Filipino sugar planters and millers, with the Philippine Sugar Institute furnishing the necessary technical assistance. These projects are expected to cut the Philippines pulp imports by 45% and will meet about 50% of the newsprint requirements. A depithing plant will be set up in the province of Tarlac, and depithed bagasse fibre will be sent to the proposed 50-ton pulp mill at Pampanga Sugar Development Co. for processing. A 60-ton newsprint plant will be built alongside the pulp mill. The third project will be a 30-ton pulp mill at the Hawaiian-Philippine Co. in Silay, Negros Occidental. These mills will use only the excess bagasse of the surrounding mill districts.

* * *

New Italian Sugar Factory[5].—The largest sugar factory in South Italy is to be put into operation in Calabria before long. The plant, situated near Strongoli (Cotrone), is to have a daily processing capacity of 2500 tons of sugar beet and an annual production capacity of 20,000 tons of refined sugar. It is to work the total South Italian sugar beet production and, besides supplying the South Italy sugar market, is expected to export sugar to the Middle East and Africa.

---

[1] F. O. LICHT, *International Sugar Report*, 1959, **90**, (Supp. 7), 102–103.
[2] F. O. LICHT, *International Sugar Report*, 1959, **90**, (Supp. 7), 102.
[3] *Overseas Review*, (Barclays D.C.O.), March 1959, 62.
[4] *Sugar y Azúcar*, 1959, **54**, (5), 80.
[5] F. O. LICHT, *International Sugar Report*, 1959, **90**, (Supp. 8), 114.



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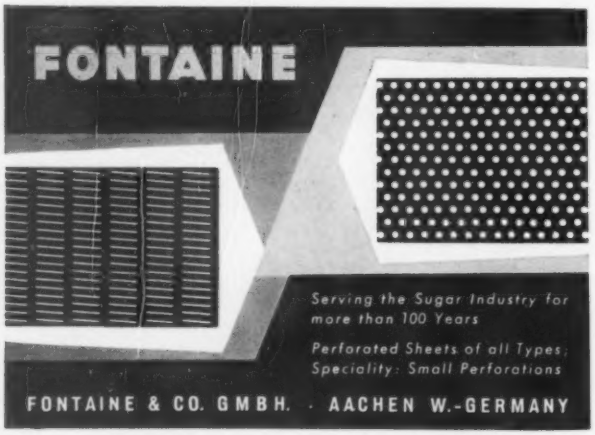
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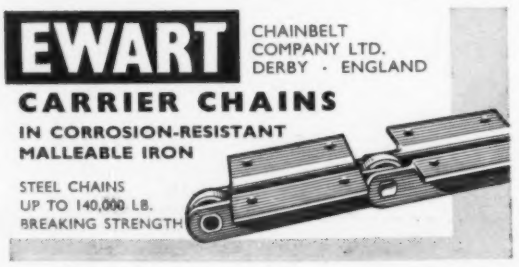

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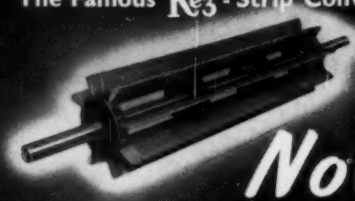

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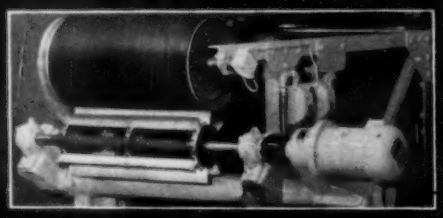

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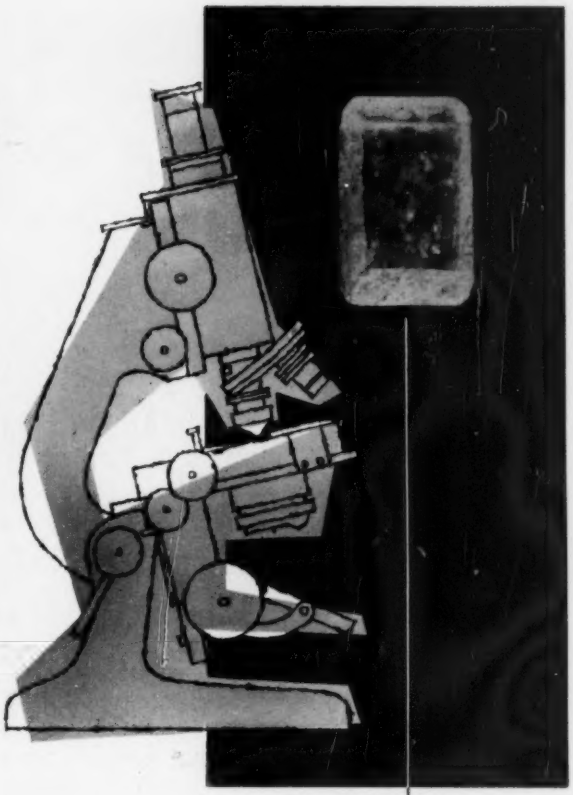

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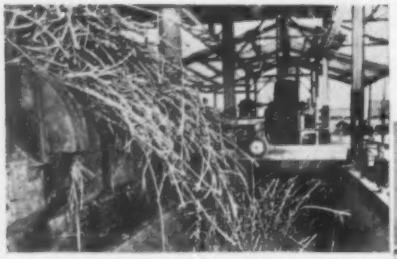

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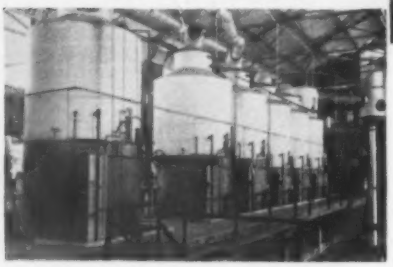

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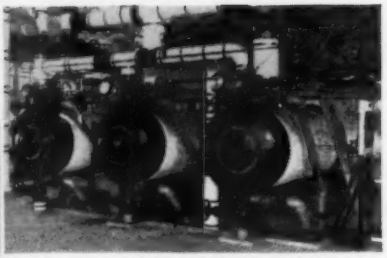

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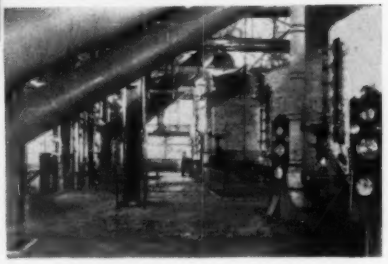

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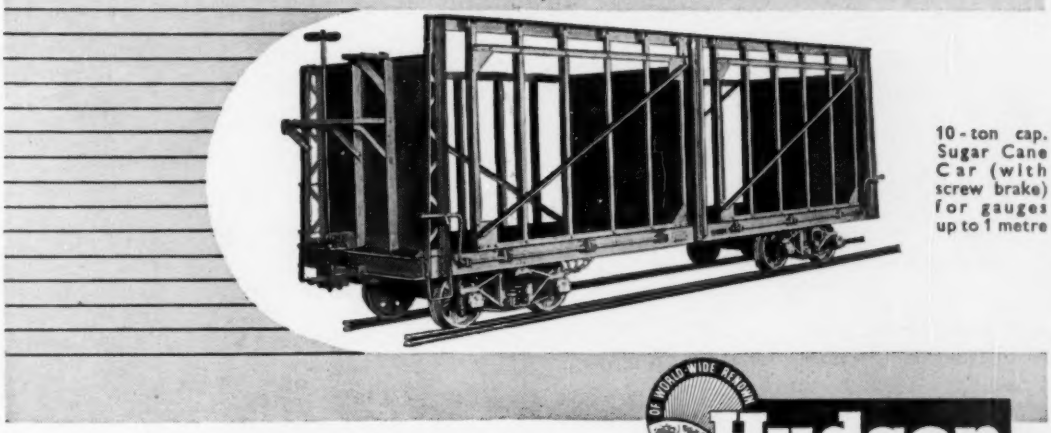

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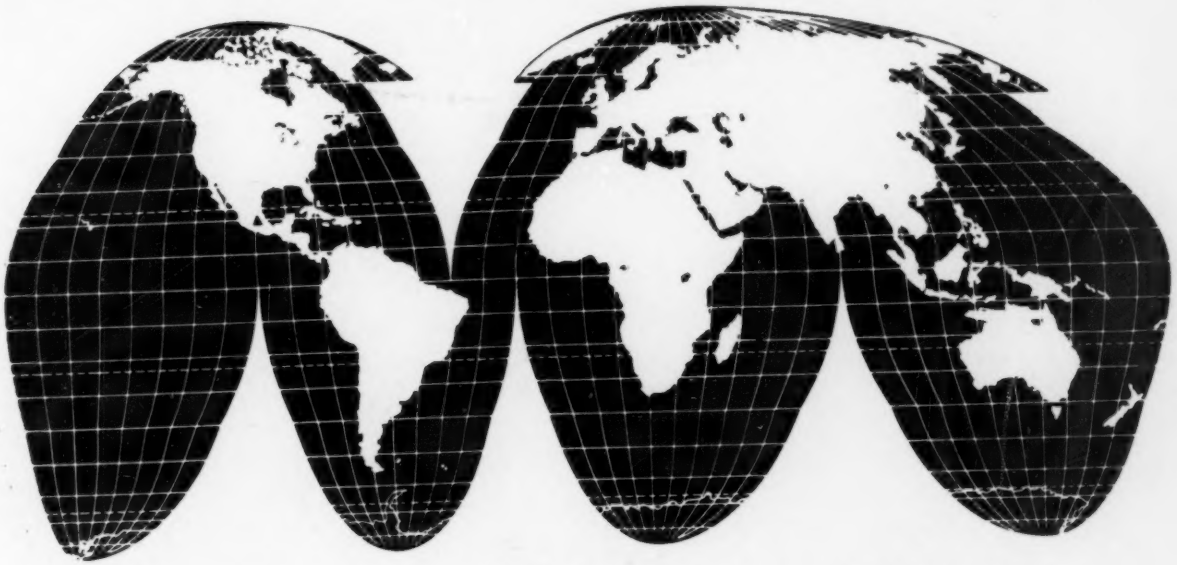

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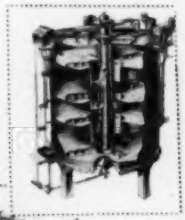

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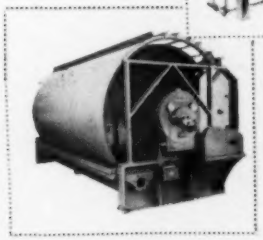

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